Lake Restoration
2009 Report and 2010 Plan

Submitted To

Joint Appropriations Subcommittee on Transportation, Infrastructure, and Capitals
and
Legislative Services Agency

Submitted By

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Executive Summary

The Department of Natural Resources (IDNR) Lake Restoration Program (LRP) focuses on restoring impaired lakes to improve the quality of life for Iowans. Communities are rallying around their water resources as they seek population growth and economic success. Communities of the Iowa Great Lakes Region, Storm Lake, Creston and Clear Lake are obvious examples, but other communities including Carter Lake, Lake View and Brighton are identifying the importance of lakes for their futures as well. The distribution and nature of Vision Iowa - "Community Attraction and Tourism" and "River Enhancement" grants, and now, Iowa's Great Places, all further emphasize the importance of water to community, quality of life and economic growth.

Iowans value water quality and desire safe healthy lakes that provide a full complement of aesthetic, ecological and recreational benefits. In the 81st General Assembly, with HF 2782, the legislature responded to our need for improving Iowa's lakes by creating the Lake Restoration Plan and Report, known as the Lake Restoration Program.

Included in Section (26) of The Endowment for Iowa's Health Account is a process and criteria for completing successful lake restoration projects (Appendix A). It directs the IDNR to report annually its plans and recommendations for lake restoration funding, as well as progress and results from projects funded by this legislation. This report has been prepared in accordance with these requirements. In addition, it describes some of the important work done by local, state and federal partners. These partnerships, along with sound scientific information, are the foundation of current and future successful lake restoration projects.

Lake Restoration Program

The Lake Restoration Program is modeled after the Federal Clean Lakes Program established in the 1970's.

- The DNR began by ranking 131 of Iowa's Significant Public Lakes (SPOLs) for lake restoration potential (see definition for SPOL - Appendix B).
- Ranking based on a 5-year Iowa State University (ISU)/IDNR assessment of water quality, technical feasibility of restoration, potential economic benefits, use by Iowans, and local support.

[Note: The following directives to the department regarding Project Goals, Process and Criteria, and Restoration Plan Guidelines are summarized from 2006 State Legislation (HF2782)]

Lake Restoration Program - Project Goals

The department shall recommend funding for lake restoration projects that are designed to achieve the following goals:

- Ensure a cost effective, positive return on investment for the citizens of Iowa.
- Ensure local community commitment to lake and watershed protection.
- Ensure significant improvement in water clarity, safety, and quality of Iowa lakes.
- Provide for a sustainable, healthy, functioning lake system.
- Result in the removal of the lake from the impaired waters list.

Lake Restoration Program - Process and Criteria

The process and criteria to recommend funding and for lake restoration projects shall be as follows:

- The department shall develop an initial list of not more than thirty-five significant publicly-owned lakes (Appendix C) to be considered for funding based on the feasibility of each lake for restoration and the use or potential use of the lake, if restored. The list included lake projects under active development that the department recommended be given priority for

funding so long as progress toward completion of the projects remained consistent with the goals of the program.

- The department shall meet with representatives of communities where lakes on the initial list are located to provide an initial lake restoration assessment and to explain the process and criteria for receiving lake restoration funding.
- Communities with lakes not included on the initial list may petition the director of the department for a preliminary lake restoration assessment and explanation of the funding process and criteria.

Lake Restoration Program - Restoration Plan Guidelines

The department shall work with representatives of each community to develop a joint lake restoration action plan.

- At a minimum, each joint action plan shall document the causes, sources, and magnitude of lake impairment, evaluate the feasibility of the lake and watershed restoration options, establish water quality goals and a schedule for attainment, assess the economic benefits of the project, identify the sources and amounts of any leveraged funds, and describe the community's commitment to the project, including local funding.
- The community's commitment to the project may include moneys to fund a lake diagnostic study and watershed assessment, including development of a TMDL (total maximum daily load).

Each joint lake restoration plan shall comply with the following guidelines:

- Biologic controls will be utilized to the maximum extent, wherever possible.
- If proposed, dredging of the lake will be conducted to a mean depth of at least ten feet to gain water quality benefits unless a combination of biologic and structural controls is sufficient to assure water quality targets will be achieved at a shallower average water depth.
- The costs of lake restoration will include the maintenance costs of improvements to the lake.
- Delivery of phosphorous and sediment from the watershed will be controlled and in place before lake restoration begins.

In-lake, in conjunction with watershed management, will meet or exceed the following water quality targets:

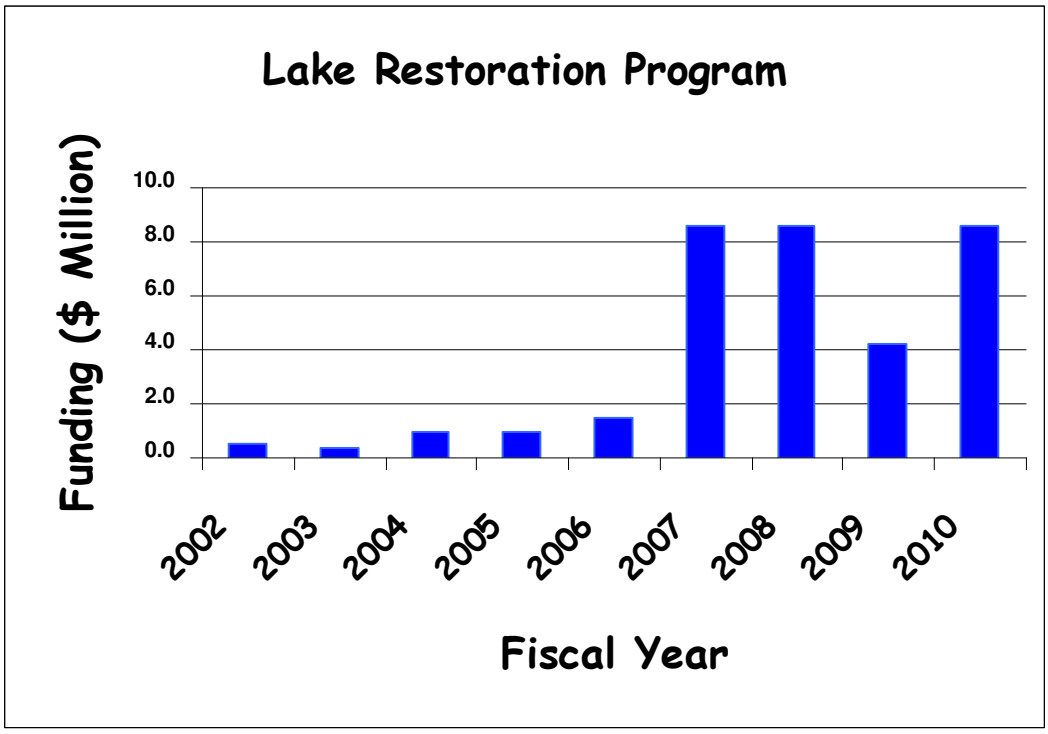
- Clarity. A four and one half foot secchi depth will be achieved fifty percent of the time from April 1 through September 30.
- Safety. Beaches will meet water quality standards for recreational use.
- Biota. A diverse, balanced, and sustainable aquatic community will be maintained.
- Sustainability. The water quality benefits of the restoration efforts will be sustained for at least fifty years.

The department shall evaluate the joint action plans and prioritize the plans based on the criteria required by the program.

Lake Restoration Program - Funding

Annual funding for FY2007 and 2008 of $8.6 million per year enabled the IDNR to improve several Iowa's lakes and proceed with implementing projects at a number of our other priority systems (Figure 1). However, the Lake Restoration Program has matured to the point where a number of multi-step projects are nearing the implementation phase; therefore, we now have more projects ready to start in a given year than we have available dollars.

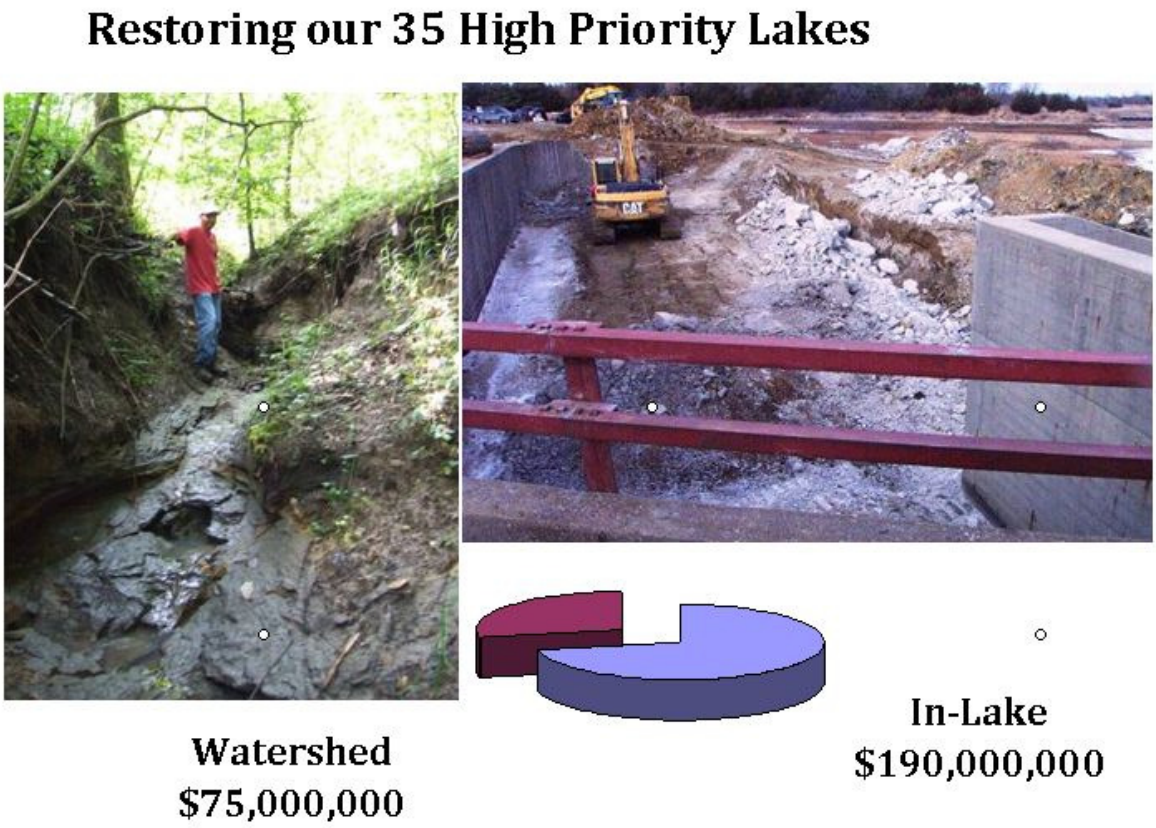
Project planning involves working with representatives of the local community to develop a joint restoration plan. For planning purposes, it is necessary that a proper assessment of the lake and watershed is available to provide restoration alternatives to meet given water quality goals. In order to achieve lake restoration goals it is critical that the IDNR form effective watershed partnerships. This includes partnerships at the local and administrative levels of government. Local, state and federal programs offer a multitude of programs for financial assistance to landowners for soil conservation and other water quality protection practices. Building community support and development of partnerships is a long-term commitment from the lake restoration program and is the foundation to the program's success.



In addition, the majority of lake restoration projects involve construction phases of watershed or in-lake implementation. A typical construction project might include the following phases: project scoping, engineering design, work bid letting, contract development, construction, and inspection. All processes must adhere to the standards and requirements of doing business as a public agency. Certain projects may require easements or land acquisition before construction can begin and/or require approvals and permits such as an archeological investigation for historic properties, an environmental review for threatened or endangered species, floodplain/404 permit, and sovereign lands permit.

Estimated Restoration Costs for the Thirty-Five Priority Lakes/Watersheds

The 2008 US EPA Watershed Survey supported an initial $197 million dollar need by Iowa to address lake restoration efforts throughout the state. Depicted below is the DNR/ISU estimate for restoring our 35 high priority Iowa Lakes.



In FY2009, the source of funding for the LRP was an appropriation from the bond proceeds of the restricted capital funds account tobacco settlement trust fund. Since these bonds were not sold, FY2009 funds were not made available to the IDNR's Lake Restoration Program until FY2010. In FY2010, the LRP received $12.8 million dollars to meet FY2009 contracted obligations and FY2010 budgeted program activities (a 50% decrease in FY2009 funding levels). The legislature appropriated $10.0 million dollars under the SF376 (IJOBS Bonding Bill) and $2.8 million under the HF822 (Rebuild Iowa Infrastructure Fund Appropriation). Maintaining future funding will be a critical component to moving these multiple year projects forward and plan for new projects.

Lake Restoration Program - Status

The intent of the program is to develop and administer lake restoration projects that achieve the following goals: ensure a cost-effective investment for the State of Iowa; foster a community commitment to lake and watershed protection; and provide significant improvement to the quality of Iowa lakes.

As indicated above, the department initially ranked 131 public lakes to prioritize lake restoration efforts. A group of thirty-five lakes, classified highest in priority for restoration, was established and served as a starting point for identifying potential lake restoration projects. An additional eight lakes have either successfully petitioned or been added into the program. Major water quality improvement initiatives are completed or near completion at seven lakes. Current program activities are in progress at twenty-six lakes throughout the state and either in the planning or initial community outreach stage at an additional eleven lakes (Figure 1).

Timelines for many of these projects usually fall within a two-year period. However, dredging or major construction projects may take even longer. Contractors face substantial costs to mobilize and set up lake dredging operations and this critical work needs multiple year commitments to secure contactors. As such, the most practical and efficient way to complete these undertakings are as continuous projects. The Lake Restoration Program has matured to the point where a number of multi-step projects are nearing the implementation phase. Table 1 highlights major work activities planned for the remainder of FY2010 and FY2011.

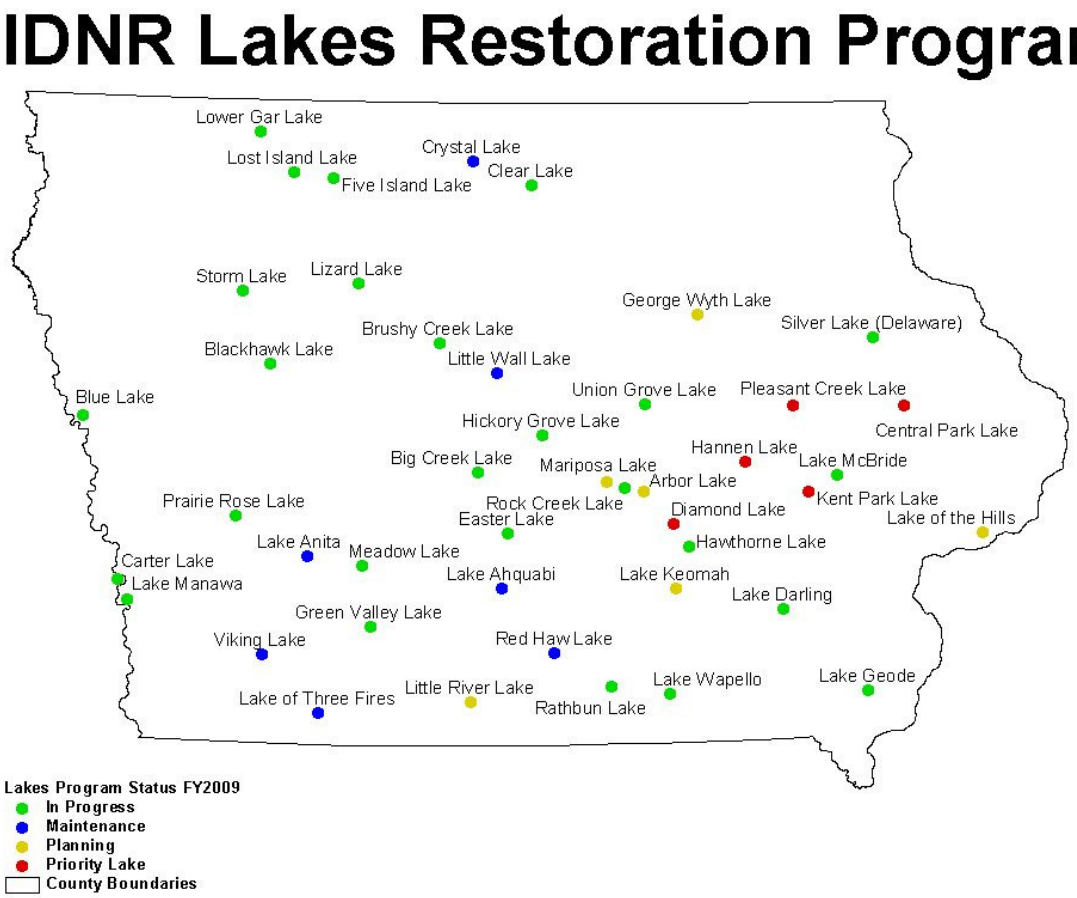


Figure 1. FY2009 Lake Restoration Program Project Status

Clear Lake, Green Valley Lake and Storm Lake are all examples of projects that have required a multiple-year funding commitment from the State in order to achieve lake restoration goals. A significant portion of the FY2009 budget was spent on the three, above mentioned, multi-phase projects (Table 2). Final components to the Green Valley Lake restoration included completion of the spillway modification, in-lake habitat and shoreline stabilization, renovation of the fishery and planned sediment removal. The DNR and local partner City of Storm Lake continued working toward their long-term sediment removal goals and restoration of Little Storm Lake. In addition, dredging efforts at Clear Lake have been completed and final planning is in place for an Aquatic Ecosystem project at the Ventura Marsh region of the Clear Lake system.

Tables 3 and 4 summarize current and planned expenditures for FY2010 and FY2011. A descriptive project summary by lake follows. The program continues to develop new projects and make contact with local communities about the lakes in their area prioritized for restoration. Current efforts are focused on continued work and completion of projects where restoration efforts have already been initiated.

Table 1. Work schedule for select multi-year lake restoration projects

Project Name	County	Projected Timeline	Project FY2010 and FY2011 Work Schedule
Blackhawk Lake	Sac	2010 - 2015	Diagnostic / Feasibility (DF) study and TMDL reports completed spring 2010. Public meeting to develop implementation plan.
Carter Lake	Pottawattamie	2008 - 2012	Engineering and design for implementation plan will be completed; partnership includes the States of Iowa and Nebraska and the cities of Omaha and Carter Lake ; Phase I - watershed improvement projects, lake alum treatment and fish renovation scheduled for 2010.
Clear Lake	Cerro Gordo	2000 - 2010	Dredging completion fall of 2009; targeted 2.4 million cubic yards was removed; continued work in the watershed; Ventura Marsh restoration – partnership with Army COE, construction phase begins Spring 2010
Easter Lake	Polk	2011 - 2014	Diagnostic Study will be completed spring 2010, including NRCS assessment of Yeader Creek. A public meeting will take place in spring of 2010 to inform the public of the results found during the surveys and studies and to develop a restoration plan.
Five Island Lake	Palo Alto	1990 - 2011	Continued support of local dredging project. DNR Lakes Program will work with local stakeholders to evaluate watershed/water quality improvement needs to compliment local dredging efforts
Green Valley Lake	Union	2008 - 2010	Silt removal and silt dike construction underway; construction scheduled for winter/spring 2010.
Lake Darling	Washington	2008 - 2011	Spillway repair/replace investigation completed; design for dam reconstruction completed; lake drained fall 2008; Dam construction, in-lake restoration (shoreline deepening, silt dike construction, fish renovation) and dredging will begin in July 2010 through November 2011; final watershed work on state property completed by fall 2010
Lake Manawa	Pottawattamie	2009 - 2014	DF study is completed; the DNR is exploring the option of utilizing dredge materials for future Iowa DOT highway projects. This will include an archeological survey followed by a pilot dredging project.
Prairie Rose Lake	Shelby	2011 - 2013	DF Study has been completed; the Shelby County Soil and Water Conservation District was awarded a $510,611 Water Quality / Watershed Protection Project Grant and work is underway; actively pursuing acquisition of a containment site.
Rock Creek Lake	Jasper	2008 - 2015	Purchased containment site adjacent to lake; construction of five sediment control structures is scheduled for 2010.
Storm Lake	Buena Vista	2000 - 2014	Continued support of local dredging project; locally sponsored WIRB Grant to improve Little Storm Lake water quality; five-year project completion plan was developed with local sponsors and will be implemented.

Table 2. Actual Budget: Fiscal Year 2009

FY08 Carry Forward Funds ($7,616,930) plus FY09 Appropriation ($10,000,000)	FY2009 Budget	$17,616,930			
Project Name	**Description**	**FY09 DNR Spent**	**Fed Spent**	**Other Spent**	**Total Expense**
Administration	Engineering, Project Management	$517,199			$517,199
Black Hawk	Feasibility Study	$47,210		$37,500	$84,710
Brushy Creek	Shoreline Protection	$8,728			$8,728
Clear Lake	Dredging/Carp study	$4,288,915		$970,000	$5,258,915
Clear Lake	Grit Collection Chamber		$17,922		$17,922
Crystal Lake	Water Quality Improvement	$23,917			$23,917
Dam Safety	Signage	$43,275			$43,275
Feasibility Studies	Restoration action plans	$424,363			$424,363
Five Island	Dredging	$200,000			$200,000
Green Valley	Spillway/Watershed	$903,410			$903,410
Lake Darling	Watershed Improvement - non cs	$92,484			$92,484
Lake Darling	Watershed Improvement		$107,761		$107,761
Lake Macbride	Road Riprap		$16,216		$16,216
Lake Manawa	Feasibility Study	$173,693			$173,693
Lake Rathbun	Shoreline Riprap	$274,000			$274,000
Lake Wapello	Watershed Improvement	$80,050	$240,150		$320,200
Lost Island Lake	Watershed Improvement	$2,928			$2,928
Lower Gar	Feasibility Study		$65,316		$65,316
Minor Projects	Minor Projects	$254,845			$254,845
Prairie Rose	Watershed Improvement - non cs	$1,840			$1,840
Rock Creek	Watershed Improvement - non cs	$476,288			$476,288
Shallow Lakes	Water Quality Improvement	$61,943			$61,943
Storm Lake	Dredging	$902,950			$902,950
Total FY2009		**$8,778,037**	**$447,365**	**$1,007,500**	**$10,232,903**
FY09 Carry forward to FY2010		**$8,838,893**			

Table 3. Budget: Fiscal Year 2010

FY09 Carry Forward Funds ($8,838,893) plus FY10 Appropriation ($2,800,000)	FY2010 Budget	$11,638,893					
Project Name	**Description**	**FY10 DNR Spent / Under Contract**	**FY10 DNR Obligated**	**Total DNR**	**Fed**	**Other**	**Total Expense**
Administration	Engineering, Project Management	$202,959	$297,041	$500,000			$500,000
Black Hawk	Feasibility Study	$121,298		$121,298			$121,298
Blue Lake	Feasibility Study	$203,527		$203,527			$203,527
Carter Lake	Engineering and Design	$100,000		$100,000		$675,000	$775,000
Clear Lake	Dredging / Carp zebra mussel study	$537,596	$723,080	$1,260,676		$250,000	$1,510,676
Clear Lake	Grit collection chamber				$34,790		$34,790
Clear Lake	SEC 206 Ventura Marsh	$620,000		$620,000	$2,618,292	$790,000	$4,028,292
Clear Lake	McIntosh Woods Shoreline stabilization		$100,000	$100,000		$10,000	$110,000
Dam Safety	Signage	$330,246	$26,479	$356,725			$356,725
Feasibility Studies	Restoration action plans	$66,938	$619,556	$686,494		$50,000	$736,494
Five Island Lake	Dredging	$200,000		$200,000		$100,000	$300,000
Green Valley	Containment site / sediment removal	$1,150,950	$200,000	$1,350,950			$1,350,950
Hickory Grove	Shoreline stabilization		$20,000	$20,000			$20,000
Hickory Grove	Feasibility Study	$148,718		$148,718			$148,718
Lake Darling	Watershed improvement - cs	$20,541	$50,972	$71,513	$61,624		$133,137
Lake Darling	Dredging, land acquisition, silt dike, dam repair	$561	$2,199,264	$2,199,825			$2,199,825
Lake Manawa	Feasibility Study / archeological survey		$25,000	$25,000			$25,000
Lake Manawa	Water quality improvement	$1,568	$498,433	$500,000			$500,000
Lake Rathbun	SEC 1135 Rathbun Habitat Restoration Project	$290,000		$290,000	$2,025,000		$2,315,000
Lake Wapello	Control structures and ponds - cs	$2,296	$76,871	$79,167	$6,887		$86,054
Lake Wapello	Repair to gabion silt structure	$65,000		$65,000			$65,000
Lizard Lake	Spillway repair, fish renovation		$50,000	$50,000			$50,000
Lost Island	Fish barrier construction / restoration	$80,000	$380,000	$460,000			$460,000
Minor Projects	Minor projects	$12,177	$237,823	$250,000			$250,000
Prairie Rose Lake	Watershed improvement - cs		$100,000	$100,000			$100,000
Prairie Rose Lake	Land acquisition	$1,560	$298,440	$300,000			$300,000
Rock Creek Lake	Watershed improvement - cs		$100,000	$100,000			$100,000
Shallow Lakes	Water quality improvement	$20,334	$159,666	$180,000			$180,000
Storm Lake	Little Storm Lake control structure	$200,000		$200,000		$200,000	$400,000
Storm Lake	Dredging, watershed improvement	$1,100,000		$1,100,000		$335,000	$1,435,000
Total FY2010		**$5,476,269**	**$6,162,624**	**$11,638,893**	**$4,746,592**	**$2,410,000**	**$18,795,486**

Table 4. Proposed Budget: Fiscal Year 2011

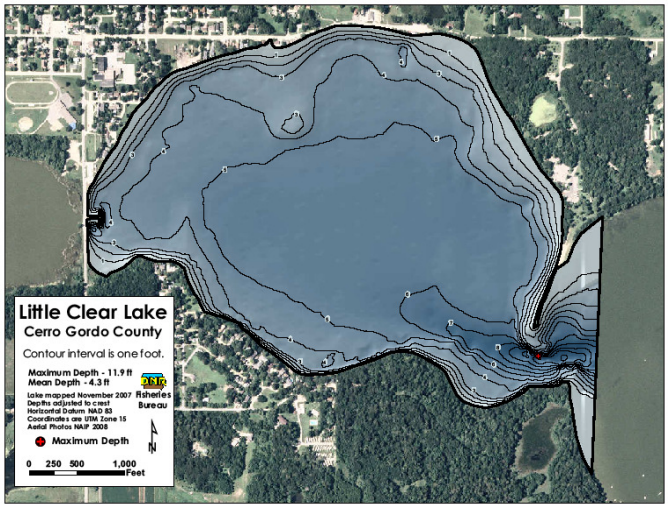
FY2010 Carry Forward Funds ($0) plus FY11 Appropriation ($8,600,000)	FY2011 Budget	$8,600,000			
Project Name	**Description**	**FY10 DNR Budget**	**Fed**	**Other**	**Total Expense**
Administration	Engineering, Project Management	$500,000			$500,000
Black Hawk	Watershed improvement	$75,000			$75,000
Carter Lake	Water quality improvement	$800,000		$2,000,000	$2,800,000
Clear Lake	Water quality improvement	$200,000			$200,000
Dam Safety	Signage	$200,000			$200,000
Easter Lake	Water quality improvement	$100,000			$100,000
Feasibility Studies	Restoration action plans	$300,000			$300,000
Five Island Lake	Dredging	$200,000		$100,000	$300,000
Green Valley	Containment site structure	$50,000			$50,000
Hawthorn Lake	Shoreline and watershed structures	$500,000		$360,090	$860,090
Lake Darling	Lake Restoration Project	$2,492,500			$2,492,500
Lake Manawa	Pilot dredging	$620,000			$620,000
Lake Wapello	Control structures and ponds - cs	$37,500	$112,500		$150,000
Lizard Lake	Water control structure	$200,000			$200,000
Lost Island	Fish barrier construction / restoration	$125,000		$145,000	$270,000
Prairie Rose Lake	Spillway modification	$800,000			$800,000
Shallow Lakes	Water quality improvement	$200,000			$200,000
Storm Lake	Dredging	$1,000,000		$335,000	$1,335,000
Storm Lake	Little Storm Lake control structure	$200,000			$200,000
Total FY2011		**$8,600,000**	**$112,500**	**$2,940,090**	**$11,652,590**

Lake Restoration Program (LRP) Highlights

Clear Lake (Cerro Gordo County)

Clear Lake is a 3,625 acre natural lake in Northwest Iowa. It has a watershed to lake area ratio of 2.3/1. In 2001, ISU completed a lake/watershed diagnostic/feasibility study. They presented a number of lake restoration options; specifically dredging of Little Clear Lake and restoration of Ventura Marsh.

- A 208 acre dredge spoil site was purchased with approximately $660,000 of LRP funds and an additional $660,000 local match.
- Contractors completed the $886,000 containment site in spring of 2008.
- The estimated cost of dredging was $8 million dollars (2.3 million cubic yards at $3.50/cu. yd.).

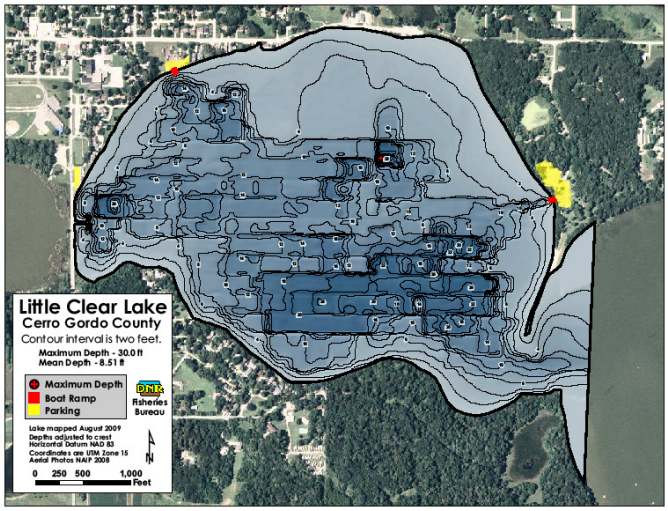


- Bids were let in January 2008 for the hydraulic dredging of the Little Lake portion of Clear Lake; the low bidder, L.W. Mattensen of Burlington, Iowa, was awarded the $6,453,000 contract (75% LRP and 25% local-match funding).
- Dredging commenced in late spring of 2008 and completed by late-summer of 2009. A total of 2.4 million cu. yds. were removed.

Little Clear Lake Pre-dredging *(Maximum Depth: 11.9 ft, Mean Depth 4.3 ft)*

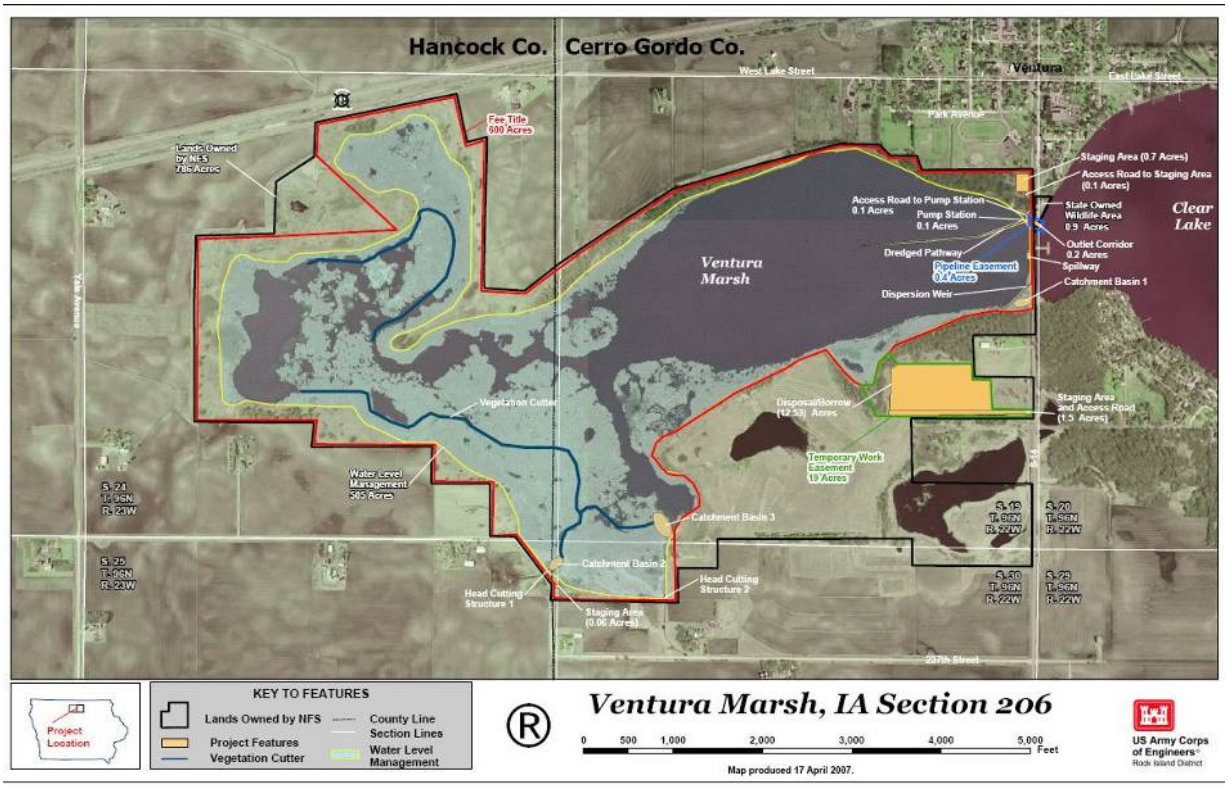
Little Clear Lake post-dredging (*Maximum Depth: 30.0 ft, Mean Depth 8.5 ft)*

Following dredging, the water clarity in the west end of Clear Lake was recorded at 3.1 feet. This was a 72% improvement from conditions observed pre-dredging (2008).



Section 206 U.S. Army Corps of Engineers
Aquatic Ecosystem Restoration Project for Ventura Marsh

- Plans have been developed for a Section 206 U.S. Army Corps of Engineers Aquatic Ecosystem Restoration Project for Ventura Marsh, which flows into the west end of Clear Lake. In its present degraded state, the marsh serves as a major source of nutrients contributing to water quality problems in the lake and is a major reproduction area for common carp.
- The Army Corp of Engineers (COE) has $2.62 million earmarked to the for a Ventura Marsh restoration project. Ventura Marsh state land credits of $790,000 and approximately $619,849 in LRP dollars will fund the IDNR's portion of the marsh restoration project.
- The goal is to work with the COE in FY2010 and FY2011 to restore Ventura Marsh and gain water level management capabilities. This will allow for fish removal and revegetation of the marsh.
- The total cost of all above mentioned activities is approximately $17 million. Of this amount, local and federal match represent 40% of the funds necessary to complete these restoration efforts.



Ventura Marsh Section 206 Project Area

Anticipated Benefits

Restoration efforts and improvements in water quality have the potential to double the annual economic return that Clear Lake generates to the local economy. The Center for Agriculture and Rural Development at ISU has projected a significant benefit to cost ratio from lake and watershed restoration at Clear Lake. Restoration of Ventura Marsh will improve the water quality of Clear Lake and help keep the Carp population under control. Local groups and DNR Section 319 continue to pursue watershed projects that have the potential to decrease sediment delivery to Clear Lake. In addition, in FY2010 the DNR and Hancock SWCD will cost share on stabilization of critical shoreline areas at McIntosh Woods State Park.

Green Valley Lake (Union County)

Green Valley Lake is a 390-acre lake constructed in 1950. It has a watershed to lake ratio of 11.3/1. A limited lake restoration project through the State and U.S. EPA's Clean Lakes Program was undertaken in the mid 1980s, however additional watershed and in-lake work was needed. Current plans to improve water quality and restore Green Valley Lake were initiated in 2006.

The local district soil group and NRCS have completed a watershed assessment and have developed a four-year plan to make needed watershed improvements. Cost share funding is now available for local landowners to accomplish soil and water quality improvement projects on their property. Iowa State University completed a Diagnostic Feasibility study in 2008 and presented a variety of restoration alternatives (i.e. spillway modification, fish restoration and dredging of coves) for consideration. A technical workgroup that includes IDNR staff, the city of Creston, Southern Iowa Rural Water, Green Valley Chemical and CIPCO meet to coordinate activities.

- A four-year watershed improvement plan, with $70,000 available annually, is being utilized, to complete approved soil and water quality improvement projects.
- The local NRCS District Conservationist has indicted that they have an extensive list of willing watershed landowners that plan to participate in this initiative. Design and construction has been initiated on several structures.
- Recent fish population estimates supported the presence of high numbers of yellow bass and common carp. Both species are considered detrimental to sport fish populations, with common carp having the additional negative impact of contributing to poor water quality conditions.
- The current design of the concrete spillway allowed common carp to enter the lake during high outflow periods. A renovation of the fishery and design of potential spillway modifications were conducted fall 2008. Spillway construction, at a cost of $510,435, was completed in May 2009 by Iowa Bridge & Culvert LC.
- A $348,767 contract was awarded to CL Carroll Company Inc. for in-lake fish habitat and protecting of the existing shoreline. This project was funded by Fish Habitat Stamp funds in cooperation with Federal Dingell-Johnson, Marine Fuel Tax and Lake Restoration Program funds.
- The Natural Resource Commission approved the acquisition of a parcel of land from LRP funding. The land is located 2.5 miles north of Creston, and adjacent to the northeast corner of Green Valley State Park. This 67.58-acre parcel was offered by the Betty E. Gater Estate for $338,000. The DNR has determined that over 30% of the phosphorus loading to the lake system comes from this portion of the watershed. In addition, this site can serve as a storage area for sediments that will be removed from the Green Valley Lake during the lake restoration process.

Green Valley Lake (Union Co.) spillway repair and modification project

- The DNR has begun the process of facilitating the removal of silt from above the dike structures in the upper arms of the lake. Approval has been given to negotiate a $1.1 million dollar contract for the removal of 220,000 cu. yds. of sediment from the existing sediment basins within Green Valley Lake. Additional work will include the addition of one more silt retention basin in the north arm of the lake.

Storm Lake (Buena Vista County)

Storm Lake is a shallow natural lake (4th largest natural lake in Iowa) with a surface acreage of 3,150 acres and a watershed to lake ratio of 4.5/1. Prior to the current dredging effort, IDNR last dredged Storm Lake in 1962. Lake depth maps developed in 1992 indicate that the 1962 dredging sites lost 77% and 46% of their volume. Studies indicate that the majority of the sediment filled these areas was from in-lake dynamics with some contribution from the watershed.

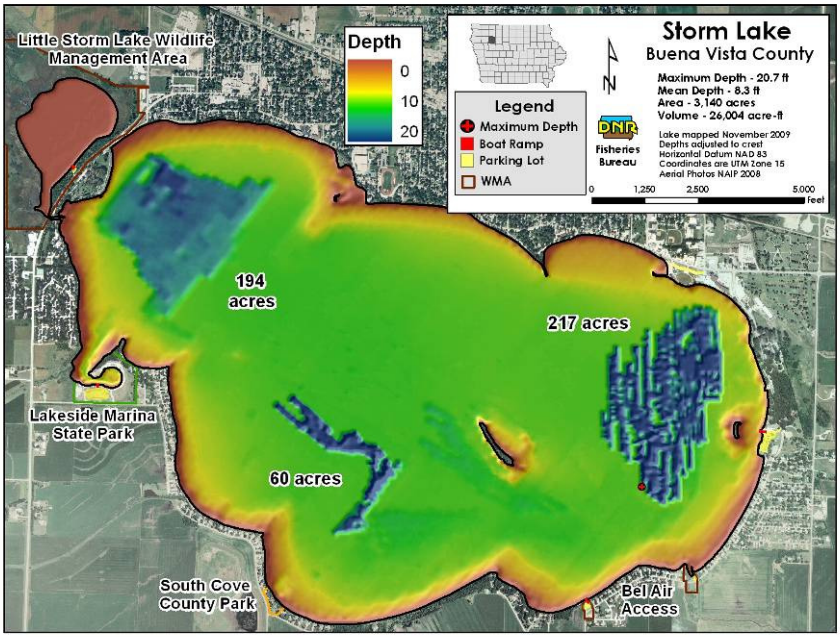
- Storm Lake constructed a dredge spoil site in 2001 and began dredging activities in 2001/2002. IDNR lake dredging removed 1.32 million cu./yds. of sediment at a total project cost of $3.3 million.
- Funding limitations restricted this initial dredging activity to 180-acres of the lake.
- The Lake Preservation Association (LPA) expressed a strong interest to continue dredging to achieve better water quality.
- From 2002 to 2009, a total of $12.75 million has been spent toward the restoration of Storm Lake

DNR Lake Restoration Program	$7.63 million
Local Contribution	$3.35 million
Federal	$1.77 million

- The City of Storm Lake leased the IDNR containment site for an additional 2-years and has since constructed a new containment site east of Storm Lake.
- The City continues to improve stormwater delivery to the lake.
- Current data supports that past restoration efforts have resulted in improvements to the water quality of Storm Lake. Water clarity averaged 22 inches in 2009 opposed to an average clarity of 10 inches in 2004. There has also been a reduction in the average concentration of total phosphorus in the water column.

<u>Joint (DNR/Local) Five-year Project Completion Plan</u>

- From 2002 to 2009, 4.53 million cu./yds. have been removed from over 471 acres of the lake



- The project goal is to dredge an additional 2 million cu./yds. of sediment
- This additional material can be placed within and will fill the current containment site
- To accomplish this goal will require an additional $5 million in lake restoration funds and $1.365 million of local match.

Little Storm Lake Ecosystem Restoration

The Lake Preservation Association (LPA) for Storm Lake applied and received a Watershed Improvement Review Board (WIRB) grant for $200,000 to reduce the sediment and phosphorous transport from Little Storm Lake in to Storm Lake. The Lake Restoration Program will match the grant with an additional $200,000.

- Little Storm Lake is a 190-acre state-owned marsh that is an extension of Storm Lake (marsh and lake elevation is the same).
- Approximately 70% of the water from the watershed flows through Little Storm Lake. Little Storm Lake originally had the ability to remove much of the sediment and nutrients from incoming waters. However, due to degradation, proper wetland function has been compromised. Under normal hydrologic conditions Little Storm Lake as the potential to function as a sediment trap for Storm Lake, but this capacity is overwhelmed during high flows. Little Storm Lake is at or near its sediment trapping capacity, which results in higher sediment transport into Storm Lake. Resuspension of sediments due to wind and other in-lake dynamics, such as rough fish, further exacerbate the total turbidity from suspended sediment and results in movement of sediment from Little Storm Lake into Storm Lake.
- This project includes a fish barrier and water retention structure between Little Storm Lake and Storm Lake and the construction of a pumping station and associated equipment. The project involves periodic dewatering of Little Storm Lake during years of favorable climatological conditions to consolidate the sediments and revegetate the area. Construction of the fish barrier would aid restoration efforts by preventing rough fish from destroying the vegetation and would decrease recruitment of rough fish by limiting their spawning area. In the future, if the diminished trapping capacity of Little Storm Lake still results in sediment moving into Storm Lake, a dredging project would be initiated to deepen the Little Lake.

Anticipated Benefits

- This aggressive dredging goal, coupled with watershed improvements and restoration of Little Storm Lake and wetland will result in significant improvements in water quality. We anticipate an average summer water clarity of 30 inches (a 300% improvement in water clarity since inception of the project) by 2015.
- In addition, lake restoration efforts so far have encouraged a $35 million economic development named “Project AWAYSIS” that has the potential to create 690 new jobs and over $28 million in new spending in Storm Lake and Buena Vista County.
- Completion of the Casino Bay Marina with $3 million dollars of State of Iowa funds which allow better access and a full service boat dealership on the lake.

Lake Restoration Program (LRP) – Projects In Progress

Big Creek Lake (Polk County)

Agency leaders to herald better water quality in Big Creek Lake
Posted: November 20, 2007

NOTE: This is a joint press release from the Iowa Department of Agriculture and Land Stewardship, the Iowa Department of Natural Resources and the U.S. Department of Agriculture – Natural Resources and Conservation Service.

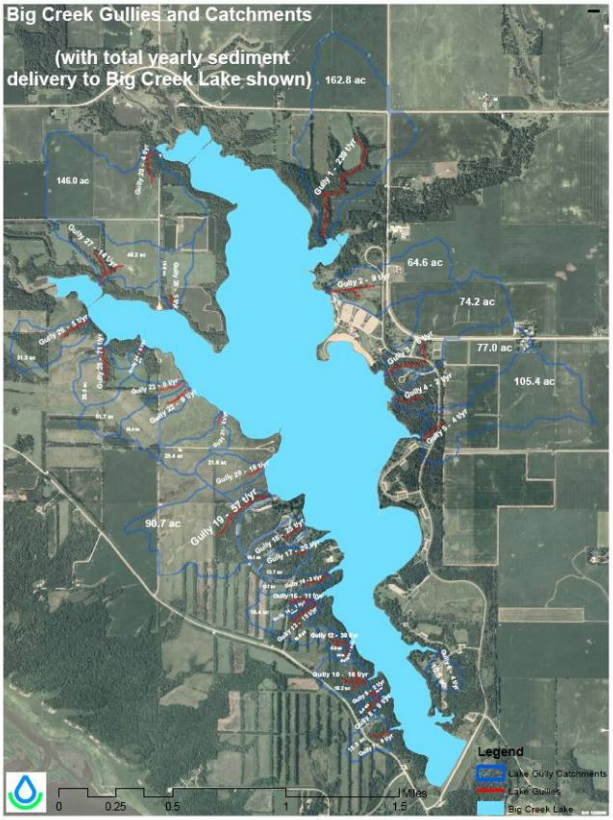
POLK CITY – DNR Director Richard Leopold, Secretary of Agriculture Bill Northey and NRCS State Conservationist Rick Van Klaveren will help the Boone and Polk County Soil and Water Conservation Districts celebrate securing a development grant to improve water quality at Big Creek Lake on Nov. 26. The districts will receive a check for $18,212 from Secretary Northey in a ceremony that begins at 11 a.m. at the Jollyboat Shelter on the west side of the park.

"Improving and protecting water quality is critical and central to what we do," said Northey. "Soil and water conservation districts, like these in Polk and Boone Counties, have a long history of fostering cooperation between landowners, government, and private organizations."
The grant will help the districts evaluate the watershed and develop a plan to address the issues to improve the water quality of the lake. "Big Creek Lake is one of 35 priority lakes the DNR has identified for lake restoration. It has tremendous value as a resource for the state," Leopold said. "This grant will help the districts develop a quality watershed plan that can keep the lake a top destination for area anglers and boaters." He added that more than 335,000 people visit the park each year, bringing more than $18.6 million annually to the area economy.

Site of Gully Erosion at Big Creek Lake

- On November 26, 2007, a development grant was received to improve water quality at Big Creek by implementing several analyses of the watershed.

- A gully analysis was performed in 2008 and a land use analysis was performed in 2009 to gain a better understanding of critical areas in the watershed.
- Several gullies with severe erosion have been identified on State property. Potential locations for catchment basins are being identified to reduce sediment loads going into the lake.



- The Wildlife Specialist, Dusten Paulus, is working with landowners in the Big Creek watershed to implement conservation programs, such as WRP and CRP on their properties to reduce sediment and nutrient input into Big Creek. He led a public meeting and a best management practices tour through the watershed. The meeting went well and it generated some interest in best management practices from multiple watershed landowners.

- The Iowa DNR hopes to finish a TMDL in December and the NRCS will then complete a Watershed Management Plan in order to secure 319 funding.

Blackhawk Lake (Sac County)

Blackhawk Lake is the southern most natural lake in Iowa located in Sac County, Iowa, near the town of Lake View. This 922 acre lake has a watershed of 14,097 acres. Data from the Iowa Department of Natural Resources indicate that the lake currently has an average depth of 5.15 feet with water clarity depth of 1-1 ½ feet. Water clarity is predominantly in the range of 0.5-1 ½ feet and phosphorus levels consistently 100-200 ppb. Very poor lake transparency due to turbidity and frequent algae blooms due to high phosphorus levels are common in the past few years. In addition, the state beach portion of the lake on the 30 Acres Campground shore was closed once in 2004 and 2007, both due to high E. coli.

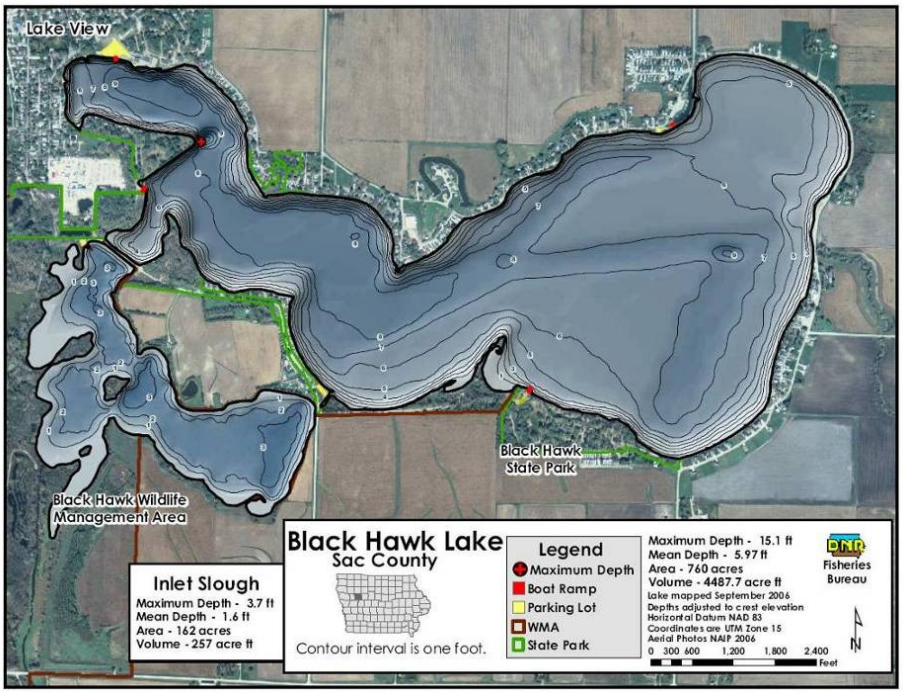
- A Citizens Advisory Committee has been formed and met several times.
- This committee locally raised $40,000 to help fund the Diagnostic / Feasibility Study; the goal of the study is to provide restoration alternatives to the DNR and local community; the report will be completed in January of 2010.
- Iowa State University (ISU) was contracted to do the D/F study;
- A Total Maximum Daily Load report is also in development to address the 303d listed of Blackhawk Lake. Algae and turbidity impairment continue; the bacteria impairment is new for the 2008 cycle. This report is scheduled for completion in the winter of 2010.
- The DNR held an initial public meeting on March 29, 2009 to discuss common goals and concerns as well as a tentative time table of the project
- Lannie Miller, DNR Fisheries Biologist, has given several tours to DNR employees and ISU personnel of the Black Hawk Lake watershed.
- A public meeting is scheduled in January of 2010 to discuss restoration alternatives for the lake and watershed and development of a Watershed Management Plan.

Black Hawk Lake (Sac Co.)
Bathymetric Map

Main Lake Area: 760 acres
Main Lake Mean Depth: 5.97 ft
Main Lake Max Depth: 15.1 ft
Main Lake Volume 4,488 ac-ft

Inlet Lake Area: 162 acres
Inlet Mean Depth: 1.6 ft
Inlet Max Depth: 3.7 ft
Inlet Lake Volume: 257 ac-ft

Total Volume: 4,745 ac-ft
Total Area: 922 acres
Mean Depth: 5.15 ft
Max Depth: 15.1 ft



Blue Lake (Monona County)

Blue Lake is a Missouri River oxbow lake located in western Monona County three miles west of Onawa and three miles east of the Missouri River. The lake was an active channel of the Missouri River in 1804 when the Lewis and Clark expedition went through the area. The lake shoreline is now part of Lewis and Clark State Park. Blue Lake is impaired by excessive growth of algae, a lack of clarity caused by this algal growth, and non-algal turbidity. These problems combine to reduce the recreational use of the lake.

- The TMDL for Blue Lake was completed in 2008. A public meeting was held to discuss the water quality improvement plan.
- A public meeting was held in 2009 to present the lake assessment and restoration process.
- A technical advisory team of conservation agencies and local stakeholders was formed and has met twice to discuss project goals.
- The waterfowl refuge boundary was altered to exclude Blue Lake and address excess nutrient inputs from geese.
- MSA Professional Services has been contracted to conduct a diagnostic-feasibility study on the lake.
- A public roll-out will be scheduled in early 2010 to introduce the project to the community

Carter Lake (Pottawattamie County)

Carter Lake is a natural lake that is uniquely located in both Iowa and Nebraska. Carter Lake is an old oxbow of the Missouri River that was isolated from the river main channel in 1877. The lake is approximately 300 surface acres at conservation surface pool elevation 970.0 feet, with a watershed area of 2,675 acres (watershed area to lake area ratio of 7.6/1). The lake is approximately 75% in Nebraska and 25% in Iowa. Park areas in Nebraska and the City of Carter Lake in Iowa dominate land use adjacent to the lake. Problems at the lake have centered on poor water quality, chronic low water levels and nuisance algae bloom. Impairments include nutrients/algae, indicator bacteria, and fish contaminants (PCBs).

- Carter Lake is a highly productive lake that exhibits poor water clarity, high nutrient concentrations, frequent algal blooms, and periodically high bacteria. Given the nature of the problems at Cater Lake, corrective measures focused on the reduction of phosphorus, which is the driving force behind algal production.
- The goals pertain to protecting aquatic life and public uses of the lake such as recreation, fish consumption, and aesthetics.
- Restoration of Carter Lake involves the cooperation of Iowa, Nebraska and the cities of Omaha and Carter Lake. A local Iowa group, the Carter Lake Preservation Society (CLPS), has been very active in moving this project forward.
- In 2006, the cities of Carter Lake, Iowa and Omaha, Nebraska, requested assistance from environmental agencies in addressing water quality problems at Carter Lake. The Carter Lake Environmental Assessment and Rehabilitation (CLEAR) Council, with assistance from numerous local and state agencies, developed a conceptual plan to address water quality concerns. The Carter Lake Water Quality Management Plan, illustrated below, was finalized in the spring of 2008.

- The IDNR, the City of Carter Lake and the City of Omaha have an agreement to develop a well on City of Omaha property that will connect to an existing infrastructure of pipes that lead to Cater Lake. The well will be used to maintain Carter Lake at a full pool range. The DNR agreed to pay the cost of the Recharge Well System. The City of Carter Lake and City of Omaha have met their match requirements for this Recharge Well System through in-kind contribution and the City of Carter Lake will coordinate the project.
- Up to $1,000,000 of funds were provided by the Iowa Legislature for the well recharge system and water quality improvement projects at Carter Lake.
- Fall 2008, the Metro Area Planning Agency (MAPA), with support of project partners, selected Tetra Tech, Inc. for the purpose of preliminary design and engineering of critical components of the Water Quality Management Plan for Carter Lake. Their work will focus on the restoration alternatives of water-budget/seepage management, dredging, and stormwater/in-lake alum treatment. By winter of 2009 projects partners will have enough information on probable cost, effectiveness and permitting issues to determine how to best move forward with implementation.

Carter Lake Restoration Project Budget	Estimated Cost
IN-LAKE	
Alum Treatment	$1,530,000
Sediment Core Study	$39,000
Fish Renovation	$200,000
Targeted Dredging	$279,300
Watercraft Management	$87,994
SUB-TOTAL	**$2,136,294**
IN-LAKE (watershed interception)	
Wetland Creation / Enhancement / Forebays	$2,019,000
Shoreline Stabilization	$899,000
SUB-TOTAL	**$2,918,000**
WATERSHED	
Bio Swales / Wet Detention Basins / Vegetated Buffers	**$794,300**
ENGINEERING	
Final Alternatives Analysis	$319,000
Final Design / Permitting / Construction Review	$647,104
SUB-TOTAL	**$966,104**
WATER SOURCE	
Well Construction / Supply Line Modification	$425,085
Final Design	$74,915
SUB-TOTAL	**$500,000**
OTHER	
Information / Education Program	$30,700
Information / Education Coordinator	$172,000
Lake Water Quality Monitoring	$120,000
SUB-TOTAL	**$322,700**
GRAND TOTAL	**$7,637,398**

Anticipated project funding partners

Iowa Department of Natural Resources – Lake Restoration Program	$2,494,624
Iowa Department of Natural Resources – Section 319	$381,744
Iowa Water Quality Review Board	$175,000
Nebraska Department of Environmental Quality - Section 319	$1,120,000
Nebraska Game and Parks Commission	$2,105,837
Nebraska Environmental Trust	$400,000
City of Omaha	$500,000
City of Carter Lake (in-kind)	$250,000

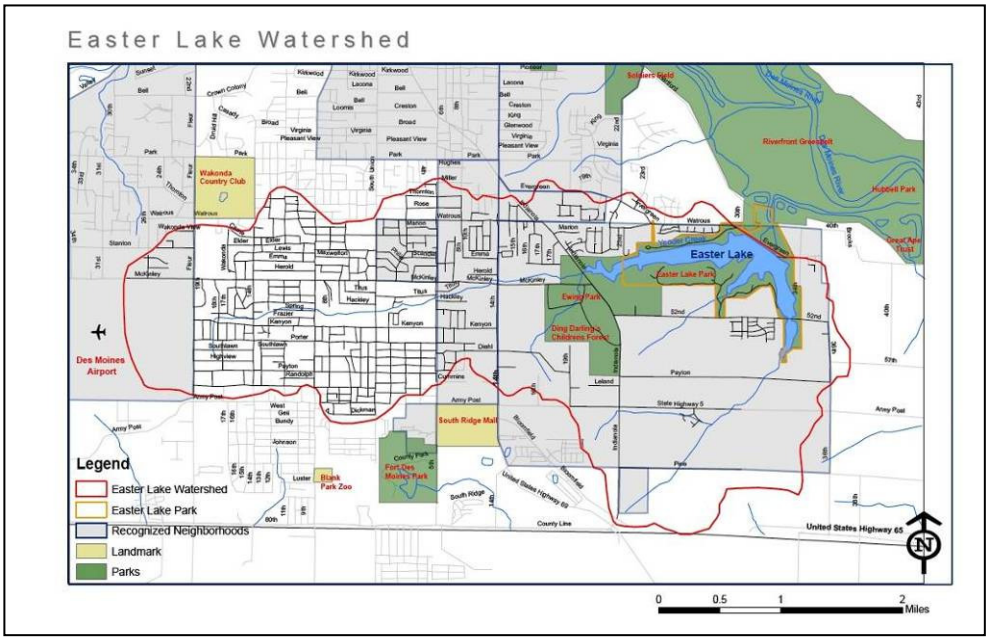
- A project coordinator has been hired to work with both the local Watershed Council and agencies. One of their primary responsibilities will be to finalize plans on a first group of watershed improvement projects and have these projects ready to bid for final design/construction by fall of 2010.

Easter Lake (Polk County)

Easter Lake is a 178-acre constructed lake with a watershed to lake ratio of 36/1. Constructed in 1967, Easter Lake began as a lake in an agriculture/suburban watershed that over the years has shifted to a highly developed urban area. Construction activities and storm water issues have contributed greatly to more than a 20% reduction in lake volume.

The Polk CCB owns and manages this area and they are very interested in developing a partnership to accomplish lake and watershed improvements. As an initial step, Iowa State University will conduct a diagnostic feasibility study with a targeted completion date of spring 2010.

- A Watershed Tactical Team met several times in 2007 and 2008 to discuss plans for Easter Lake and the watershed. Representatives from Iowa State University, NRCS, Iowa DNR, City of Des Moines and Polk County attended these meetings.
- Iowa State University conducted a survey (2008) of residents in the watershed to determine their knowledge and attitudes of the lake and its watershed. The complete diagnostic / feasibility study is due spring of 2010.
- The Natural Resources Conservation Service entered into an agreement with the DNR to provide the DNR with a technical approach to assess the condition of the Yeader Creek Watershed and estimate its sediment delivery to Easter Lake.



- Polk County and the Iowa DNR are working together to design a park and lake user survey to investigate how satisfied the users are and what they would like to see improved. This survey will take place in 2010.
- A public meeting will take place in spring of 2010 to inform the public of the results found during the surveys and studies and to develop a restoration plan.

Five Island Lake (Palo Alto County)

Five Island Lake is a 950-acre natural lake located on the north side of the town of Emmetsburg, Iowa in Palo Alto County. In 1989, following five years of diminished recreational opportunities and poor water quality conditions due to low lake levels, a group of concerned citizens formed the Five Island Lake Board. They established two major goals for the project: Increase the lake water depth; and, improve the lake water quality.

- In 1989, a group of concerned citizens formed the Five Island Lake Board.
- The Lake Board has stabilized almost 10.5 miles of lake shoreline, dredged over 5 million cubic yards of silt, and worked in the watershed to reduce nutrients and sediment from entering the lake.
- Funding for this project has been a combination of state and local matching grants.
- Local monetary contributions to date exceed $1.2 million.
- State funding as of July 2007 is $980,000.
- In addition to the dredging portion of their project, the Lake Board is evaluating the need for additional work in the watershed and in-lake management strategies to achieve the desired water quality goals.
- The DNR and the City of Emmetsburg entered into an agreement for dredging of Five Island Lake that will occur before June 30, 2010. Funding from LRP is $200,000 for both FY2009 and FY2010.
- Summer 2008 tour with the DNR Director Leopold, State Senator Kibbe, local stakeholders and the DNR Lakes Program reviewed progress the need for continued watershed work to compliment local dredging efforts.

Five Island Lake – Areas highlighted in purple indicate potential regions of dredging activity.

Hawthorn Lake (Mahaska County)

The Mahaska County SWCD applied for and received a watershed assessment grant from IDALS. This assessment was completed in the winter of 2007. The Mahaska SWCD applied for and received a WIRB grant of $360,900 toward Lake Restoration activities. In addition, a total of $75,371 in Publicly Owned Lakes (POL) funds will be available through the next four years. This is in addition to $75,247 in POL funds spent in FY 2009 and $58,000 to be spent in FY 2010. A total of $20,000 of the 2010 POL funding has been spent creating approximately 800 feet of terraces and one grade stabilization structure to date. The total lake restoration project cost of Hawthorn Lake is projected to be $977,000. Lake Restoration funds of $450,000 will be utilized for in-lake shoreline stabilization, deepening, and watershed improvement on state lands.

Hickory Grove Lake (Story County)

The Hickory Grove Watershed is located in Story County, Iowa. It has a drainage area of 4,026 acres and landuse distribution of 84.7% row crop, 9.8% grass, 1.6% forest, 2.2% water, 0.9% barren and 0.7% artificial. The Hickory Grove Lake has been identified as an important recreational resource to the citizens of Iowa. Hickory Grove Lake is experiencing event driven water quality problems. In general, the Hickory Grove watershed has few elevation changes and much of the agricultural land is under tile drainage management. Storm related surface runoff has led to gully erosion, debris and nitrogen spikes immediately after these events. The eastern end of the lake is now sediment filled, limiting boat access. The fishery is healthy; however, carp have destroyed most vegetation and IDNR is considering a lake drawdown after the fish population estimate in the fall of 2010. The lake has a designated use of primary contact recreation and is listed on the 2008 303(d) Impaired Waters Listing for elevated bacteria concentrations. TMDL development is a high priority and is scheduled for 2012.

- Watershed Tactical Team met in the summer of 2008 to discuss future direction of the lake
- Development grant was received in 2008 to determine critical areas in the watershed where significant quantities of sediment and nutrients are delivered to the lake. In 2009, a land use assessment was completed by the NRCS.
- The Watershed Tactical Team plans to meet with Iowa State University professors (engineering) to discuss potential options for improving water quality of the lake.
- Iowa DNR Lakes Restoration contracted with the Agricultural and Biosystems Technology Department at Iowa State University to complete a diagnostic / feasibility study. ISU will collect data and develop specific models that will assist Story County and Iowa DNR in protecting and improving water quality and fishery at Hickory Grove. ISU will also take part in public meetings and work closely with watershed landowners.
- The Watershed Tactical Team met in November and has developed a tentative public meeting agenda for February 2010. This meeting will incorporate experts who can discuss practical use of conservation tillage and cover crops, which are applicable to Hickory Grove's flat watershed.

Debris below headwall east of Hickory Grove Park

Lake Darling (Washington County)

Lake Darling is a 267-acre man-make lake, constructed within a 1,400 acre state park, with a watershed to lake ratio of 46.5/1. Initially impounded in 1950, it has historically been a fair fishery plagued by severe in-lake siltation and poor water quality. Sedimentation has reduced the lakes original 305 surface acres

to 267 acres. During the last five years, extensive watershed soil conservation work has reduced sediment delivery to the lake by 40%. Additional soil conservation work took place on state/private land in 2008 and 2009.

- Acting on the recommendations of the completed engineering report, the IDNR will repair the dam and address spillway leakage.
- IDNR has begun negotiations with several landowners for acquisition of a dredge spoil containment site.
- The Iowa Department of Natural Resources (DNR) relaxed the fishing regulations at Lake Darling on September 12, 2008. This allowed anglers to more freely harvest fish before the lake is completely drained to repair a spillway leak, extend the dam, and to perform a lake restoration project.
- With the lake drained, in-lake restoration and spillway construction is planned for late spring of 2010 with a tentative completion late summer of 2011.
- Sediment ponds, road culvert risers, boat ramp designs, watershed work and archaeological surveys are all part of Lake Darlings continuing restoration activities.

- The Management Plan includes all in-lake improvements to be done while the lake is drained and sustaining those improvements over the next 50 years. The Plan and its affects will benefit not only Lake Darling State Park but also the local community and economy.
- The lake was first drained in November 2008, and subsequently, has refilled and drained numerous times since its initial draw down.
- Weather has allowed the completed construction of five ponds and one terrace as well as six road culvert risers and one road culvert extension within park boundaries. In the watershed, final plans have been completed for an erosion control pond involving four landowners.


Lake Darling Road Riser

- Reduced sediment and nutrient inputs into Lake Darling will result in increased water clarity and decreased algal blooms. The growth and condition of fish such as largemouth bass inhabiting the lake may also improve, as they will be able to see and capture prey more successfully. The ponds themselves provide fishing opportunities and are already stocked with bluegills. In spring 2010, the ponds will be stocked with channel catfish and largemouth bass. All of the ponds and riser structures are visible from the park roads and are easily accessible.

Pond Created by Road Riser

- The DNR Fisheries Bureau and Engineering Bureau, has also been working on plans for the construction of a new boat ramp and parking area. The ramp and parking lot will be constructed on the shoreline before the entrance of the existing campground and will replace the current campground boat ramp Dolan said.
- Archaeological surveys are being conducted in areas anticipated to be impacted by project construction activities. All archaeological work has been completed with the exception of a single site, which has valuable historical significance.

- Archaeologists will be exploring this site further to insure they collect as much information as possible regarding past civilizations before restoration work moves forward. The last phase of archaeological work will be completed in spring of 2010.

Lake Darling Estimated Restoration Project Costs

Sediment removal (300,000 yd3)	$1,800,000
Dam reconstruction & water level increase	$1,700,000
In-lake silt dam construction	$500,000
Ponds, terraces, risers, wetland	$286,000
Shoreline stabilization & jetty repair	$215,000
Spoil retention dams	$105,000
Handicap accessible jetty (REAP Land Management)	$75,000
	Total = $4.7 million dollars

Lake Macbride (Johnson County)

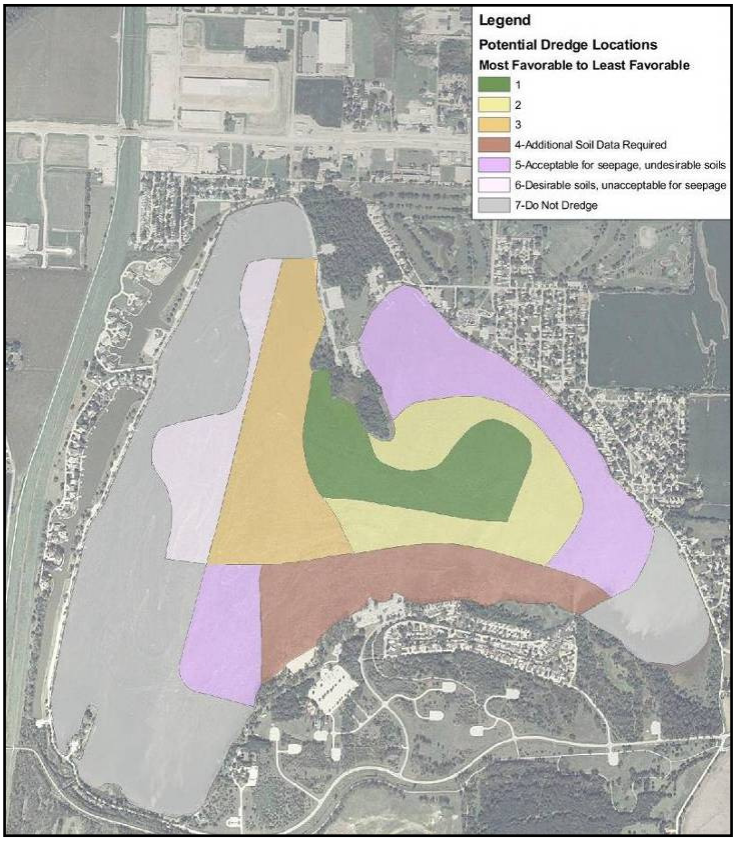
Lake Macbride (Johnson County) is a 940 acre lake owned by the State of Iowa. It has a 17,029 acre watershed that is mainly on private property. The watershed ratio is 18:1. A TMDL study has been completed in 2005 and another scheduled for 2010. The Lake Macbride Watershed Advisory Committee was formed in 2001 and since that time around $725,000 has been spent on conservation practices and

education in the watershed. Amy Bouska is the watershed coordinator located at the Johnson County NRCS office.

- In 2007, 900 feet of eroding shoreline was protected with rock riprap in the upper south arm of the lake.
- 2008 – Proposed construction of five erosion control structures, one sediment control basin and two bioretention gardens within the State Park boundaries. The archeological survey and DNR Environmental Review have been completed, but the project still needs to receive clearance from SHPO before we can proceed with final design and bid letting. Construction is planned for 2010.
- A timber management plan has been developed above the gully control structures to reduce the erosion problems. Invasive and undesirable trees will be removed and seasonal burning has be used to open up the canopy and promote under story growth.
- The DNR and Johnson County entered into an agreement for protection of approximately 1,200 feet of shoreline along the Cottage Reserve Road with riprap. Project was completed fall 2008.
- The flood of 2008 did some extensive damage to shorelines, islands and fishing jetties. Most of this damage with be repaired in the winter of 2009-2010 and paid for by a combination of lake restoration and FEMA funds.

Lake Manawa (Pottawattamie County)

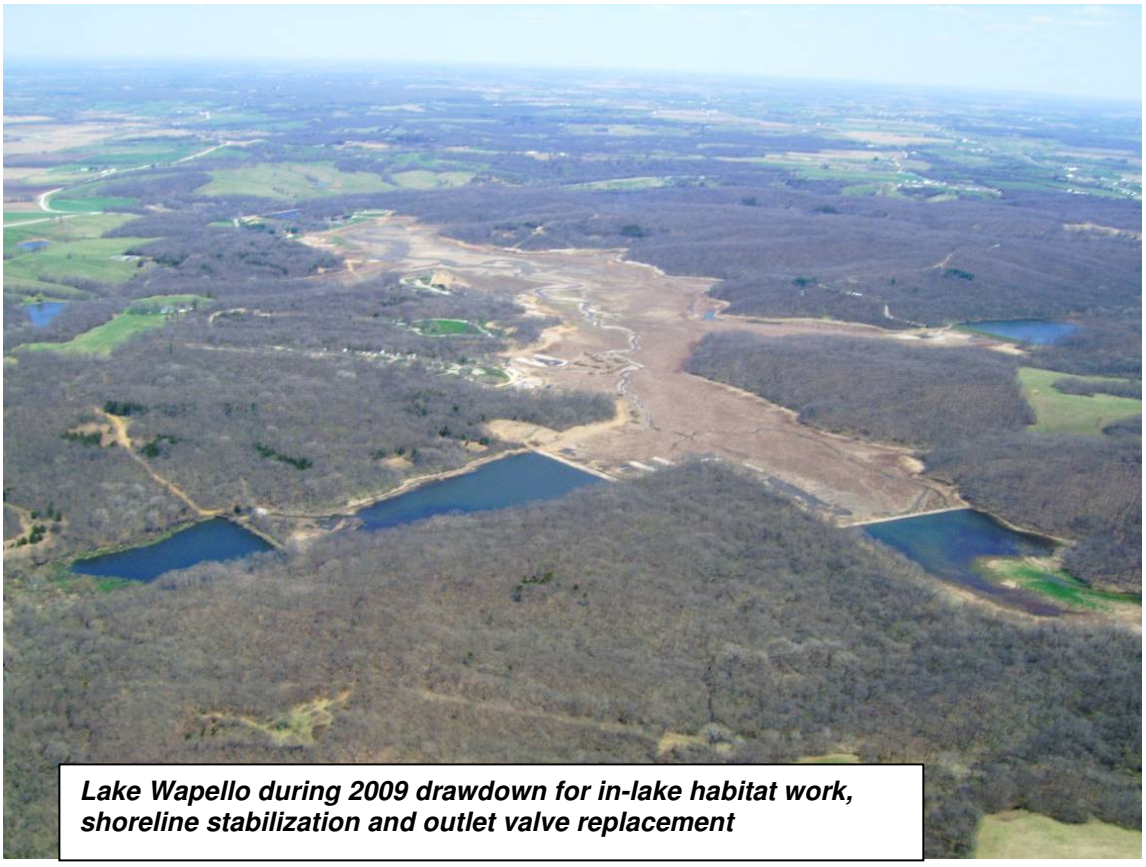
Lake Manawa is a 715-acre natural lake with a watershed to lake ratio of 3.5/1. Mosquito Creek supplies additional water to the lake. Past lake dredging work in the 1960s deepened significant portions of the lake. However, maximum lake depth does not exceed 13 feet with large expanses of 6 to 7 feet deep water. The Iowa Department of Transportation approached the IDNR to explore the possibility of dredging the lake for sand to use for highway construction. However, there is concern about whether they can remove sand materials from Lake Manawa while still maintaining the hydraulic seal between the lake and the fluctuating Missouri River.



- The Iowa DOT and IDNR met during spring of 2007 and fall of 2008 to discuss opportunities to obtain highway building materials from Lake Manawa sediments.
- The IDNR hired Tetra Tech to conduct a diagnostic and feasibility study and review the option of dredging as a potential lake restoration activity.
- Tetra Tech also completed a Jurisdictional Wetland Delineation for Lake Manawa Pilot Dredge Spoil Site.
- The next phase will be to develop a pilot dredging project. This proposed “Pilot Dredging Project” phase would provide data that would reduce the risk involved both in providing the materials to the specifications required and in the ability to control additional seepage from areas along the lake bottom, where underlying sands would become exposed. If all assumptions in this study can be proven true, the project remains a viable opportunity for both IDNR and the Iowa Department of Transportation (IDOT).
- The IDNR continues to meet with groups such as the “Friends of Lake Manawa” to solicit support and to assist in moving the lake/watershed restoration project along.

Lake Wapello (Davis County)

- The Lake Wapello restoration project is in the implementation phase of constructing 31 structures within the watershed, 11 of which are on state property. Total cost is estimated at approximately $800,000. Structures on private land are being funded through IDALS Watershed Protection Funds (50% of total), 25% EQUIP, and 25% landowner cost share. Structures on state ground are being constructed at a cost of $320,000; and are funded by the 319 (75%) and Lake Restoration (25%) programs.
- In-lake restoration activities were completed in April 2009. Projects included in-lake fish habitat improvement (placement of approximately 1000 cedar trees and placement of approximately 440 ton of rip rap and 1600 ton of gravel. All existing fishing jetties were improved and three new jetties were constructed. One existing boat ramp was improved. All of these efforts were funded through fish and wildlife trust fund and federal aide to sport fish restoration funds. Lake Restoration funds were utilized for shoreline armament and shoreline deepening (movement of approximately 15,000 cubic yards of material), approximately 4,000 ton of rock was used to armor approximately 2,500 linear feet of shoreline, and one new silt dam was constructed. In addition, the aging and unreliable outlet valve was replaced. Total in-lake construction cost was $394,142.74, of which $267,649.50 were Lake Restoration funds.
- The Lake Wapello fish population was renovated in 2008; however, this process was repeated again in 2009 due to the illegal introduction of gizzard shad into the system once again. Chemical cost of this renovation was approximately $30,000 each time, funded through fish and wildlife trust fund dollars.



Lake Wapello during 2009 drawdown for in-lake habitat work, shoreline stabilization and outlet valve replacement

Lost Island Lake (Dickinson County)

Lost Island Lake /Barringer Slough / Blue-wing Marsh Complex

An aggressive and comprehensive plan to improve water quality in the > 2,200-acre complex by reducing existing carp numbers, preventing remaining rough fish from entering most spawning areas, and conducting beneficial draw downs on associated wetland areas (780-acre Barringer Slough, 150-ace Blue-wing Marsh, others) to eliminate rough fish and allow for the germination of aquatic plants and the consolidation of bottom sediments.

- The project will require an innovative plan to allow for the removal of up to 75% of the exiting carp biomass, the aggressive stocking of predatory fish, and the new construction or rehabilitation of up to 4 water control structures and 5 fish barriers throughout the complex.
- During summer 2008, DNR-Fisheries used mark – recapture techniques to estimate in-lake carp numbers and biomass.
- Recently, Ducks Unlimited, Inc. was awarded a contract to design effective water control and fish barrier structures.
- The survey and design work began during summer/fall 2009 and infrastructure construction is scheduled to begin in 2010. Carp removal and targeted drawdowns of various parts of the complex may begin in 2010 or 2011.
- During winter 2008-09 Ducks Unlimited completed the topographical survey of the entire Lost Island Lake complex and recently completed the conceptual design work for the 4 water control and 5 fish barrier structures.
- Nearly 70 local stakeholders attended a December 2009 public meeting and voiced strong approval for the design work. Presently, DU is working on engineering plans for the structures and DNR, DU, and their local partners plan to construct most, if not all, the structures during fall 2010 and winter 2010-11. Also at present, rough fish are being aggressively removed from Lost Island Lake, large numbers of predatory fish continue to be stocked in Lost Island Lake, and various basins within the complex are being dewatered to eliminate rough fish, create favorable conditions for re-vegetation, and to prepare areas for fall construction.

Lower Gar Lake (Dickinson County)

- Local concerned citizens and business owners that live on or recreate on the Iowa Great Lakes system, specifically Lower Gar, Minnewashta and Upper Gar, formed The Three Lakes Improvement Association.
- IDNR Lakes Restoration staff met with this group several times in the past years to discuss lake water quality and water depth issues.
- Iowa State University has been contracted to conduct a diagnostic/feasibility proposal to examine lake issues.
- This study, funded locally for 25% of the cost, will examine historic soft sediment deposition, potential removal of a portion of these sediments and the resulting impact on lake water quality. The study is scheduled for completion winter 2010. A spring meeting is planned to plan for a public role-out of the project.

Meadow Lake (Adair County)

Meadow Lake is a 34 acre public owned lake located six miles north of Greenfield in Adair County. Constructed in 1963, the lake sits within a larger 320 acre fish and wildlife area owned and managed by the Iowa Department of Natural Resources to provide fishing, hunting, and other outdoor recreation activities for the public. Overall, Meadow Lake has provided good fishing for largemouth bass, bluegill, crappie, and channel catfish for over 40 years. Meadow Lake was added to the impaired waters list (303d) in 2004 for algae. In 2008 turbidity was added as an impairment in addition to the algae. The presence of aesthetically objectionable blooms of algae and poor water transparency impair the primary contact recreational uses at the lake.

The IDNR lowered the water level in Meadow Lake starting late summer of 2008 to facilitate a significant fish habitat and shoreline stabilization project. This project was completed in March 2008 and included 740 feet of shoreline stabilization, rock reefs (2), pea gravel spawning beds (3) and a rock field. This project will enhance the fish habitat in Meadow and have water quality benefits. The shoreline stabilization work addressed all the actively eroding shoreline in the lake. The total cost of this project was $65,000 including $22,200 for stabilizing eroding shoreline. There were three sources that contributed to this project the state of Iowa Fish and Wildlife Trust Fund ($15,250), Sportfish Restoration ($45,750), and the Jensen-Butler Conservation Foundation ($4,000).

- An in-lake structure is planned at Meadow Lake to achieve sediment and phosphorous reduction from 236 acres of the watershed. The project is planned for winter 2009 construction.

Prairie Rose Lake (Shelby County)

Prairie Rose Lake is a 173-acre constructed lake with a watershed to lake ratio of 23.5/1. Problems at the lake center on low fish populations, historic lake siltation and poor water quality. Lake improvements in recent years include; jetties and fish structure (1998), sediment basin and shoreline riprap (2001) and sediment basins (2004). Local efforts have accomplished significant work in the watershed and identified additional work for completion.

- IDNR Fisheries and Parks staffs have been meeting with NRCS, IDALS, and others about remaining watershed work and initial lake restoration plans.
- A diagnostic/feasibility study was completed during 2008.
- A watershed assessment was conducted followed by a grant to accomplish targeted soil conservation work in the watershed.
- The Shelby County Soil and Water Conservation District was awarded a $510,611 Water Quality /Watershed Protection Project Grant

Prairie Rose Soil Conservation Practice

- IDNR is actively looking for a dredge spoil containment site, an important component to the in-lake restoration work, and have begun negotiations with several landowners for acquisition of a dredge spoil containment site.
- The Prairie Rose Watershed Council was formed at a public meeting in May of 2008 and continues to meets regularly assisting in the restoration process.
- Design work has been completed on two rock-chute wetlands and two road risers and plans are being made for construction in 2010.
- An archeological survey has been completed on state lands that will be disturbed by construction

Rathbun Reservoir (Appanoose County)

- Rathbun Land and Water has been successful in assisting 400 farmers with BMP application for priority land in 24 targeted sub-watersheds; they helped apply BMP on 16,500 acres (goal: 60,000 acres); these practices will reduce sediment delivery to Rathbun Lake by 25,600 tons per year (goal: 84,000 tons). In addition' these BMPs will reduce phosphorus delivery to Rathbun Lake by 110,400 pounds per year (goal: 360,000 pounds).
- In-lake work is planned to protect vital habitats and improve water quality in several bays on the lake by protecting the channel-side points. By stabilizing these areas' shoreline loss will be reduced and water quality will be improved.
- Lake Restoration funds will be matched with U.S. Army Corps of Engineers for a COE 1135 Habitat Rehabilitation project. The project was awarded on September 22, 2009 at a total cost of $1,770,845.14 with one additional site still pending. Lake Restoration contributed $274,000 in FY2009 funds and will provide $290,000 in FY2010 as a state match toward this project. Construction is scheduled for spring of 2010. A total of eight sites will be addressed and total rock placement will exceed 45,000 tons of rip rap. Lake Rathbun is currently being lowered to four feet below normal pool to complete this project. In addition to water quality improvements, fish habitat will be improved for a number of important game fish species.

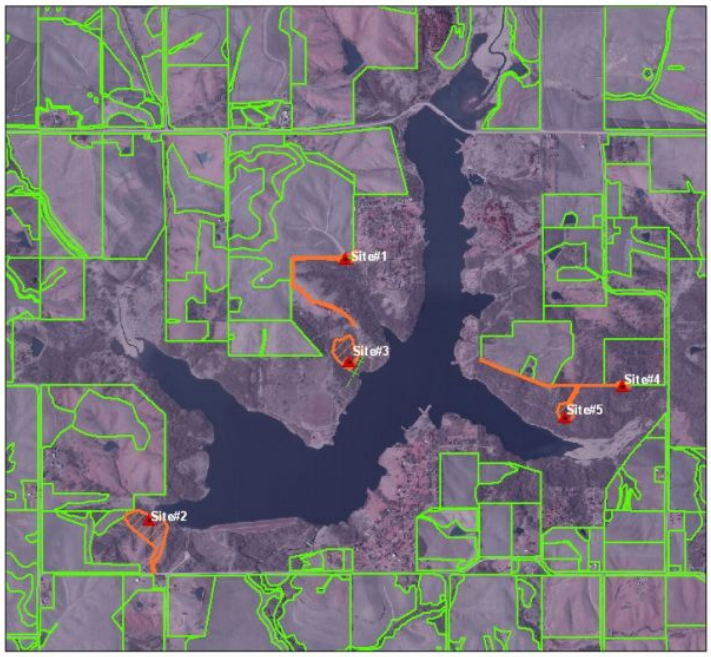
Rock Creek Lake (Jasper County)

Rock Creek Lake is a 491-acre lake constructed in 1952. The lake has a watershed to lake ratio of 54/1. Over the last 50 years, it has lost almost 40% of its lake water volume and 102 lake surface acres. ISU completed a D/F study in 2000. Local efforts have accomplished significant work in the watershed; however, local and state partners need a renewed effort to move this project forward. Continued watershed improvement projects have been a difficult "sell" to area landowners.

A fall 2008 technical work group meeting resulted in an outlined approach to meet the necessary reductions in sediment and nutrient delivery to Rock Creek Lake. It focused on dividing the total watershed into larger subwatershed segments, and then designing larger watershed structures that will require a higher government percentage contribution to put these water quality improvement practices in place. Several landowners had expressed interest in this concept; however, due to the inability to

implement projects on private ground the requested 1 year watershed project extension was not granted and the project contract will expire December 31, 2009.

- During fiscal year 2009 many small practices such as waterways and small basins were completed in the Rock Creek Watershed. A sediment reduction of 1,439 tons/year and 750 acres protected was achieved from June 2008 to September 30, 2009.
- Work on the Rock Creek Watershed Project at this time is limited to five grade stabilization structures in the state park (see image). These sites have been selected for the placement of 3 ponds and 2 large basins. Construction will most likely begin spring/summer 2010.
- The Natural Resource Commission approved the purchase a parcel of land located in northeastern Jasper County for the appraised price of $475,409. The 138.5-acre property is located 7 miles northeast of Kellogg.



- The tract is adjacent north and east of Rock Creek Wildlife Management Area (WMA), and just north of Rock Creek State Park. This tract will increase the Rock Creek WMA to 835 acres. In addition, the acquisition will provide wildlife habitat, improve water quality, and enhance public recreation to this area and serve as a possible future dredge spoil containment site.
- This challenging watershed will require this and other innovative concepts to significantly reduce sediments and nutrients from reaching Rock Creek Lake and to eventually allow us to move forward with the D/F studies lake restoration measures.

Silver Lake (Delaware County)

Silver Lake is a small, natural lake enlarged by the construction of a dam. It has a 34-acre surface area lake and a lake ratio of 6.4/1. UNI completed a diagnostic feasibility study in 2001 and the IDNR completed a TMDL analysis in 2001. Lake depth maps and sediment borings indicated excessive lake sedimentation depths ranging from 0.5 to 4 feet. A lake watershed assessment conducted in 2001, documented areas of high phosphorus input in the watershed. The assessment also identified excessive manure application levels as a problem. NRCS continues to work with landowners in the watershed to reduce nutrient and sediment lake inputs.

- In 2001, an engineering firm evaluated dam integrity and leakage issues. The construction firm hired to repair the dam and eliminate dam safety issues completed the work fall of 2007 at a cost of $314,950.
- Lake water overflowed the Silver Lake spillway in April of 2008 following dam repair and wet weather conditions. According to local reports, this marks the first spillway overflow since 1993. Silver Lake reached full pool in April of 2008 and that full pool level was maintained until approximately August of 2008. The lake now contains about double the volume of water it did in the period immediately prior to the dam repair during the fall of 2007. The current lake level in Silver Lake is approximately 6 inches below crest following a period of dry weather.
- Silver Lake suffered a moderate winterkill during the severe winter of 2007-2008 that effectively eliminated largemouth bass and channel catfish from the system and reduced the bluegill population. Largemouth bass were restocked in June 2008 and bluegill have recovered favorably following a 2008 growing season. A winterkill also occured in the winter of 2008-2009, but it was very minor.

Silver supported moderate recreational fishing during the open-water season of 2009 with good harvest of 6-7.5 inch bluegill and additional catches of 10-12 inch largemouth bass and 18-26 inch northern pike. Almost no fishing occurred on Silver during the 2007 and 2008 fishing seasons, so we are pleased with the increased recreational use.

- The vegetation and clarity in the lake seem to be responding favorably to increased water volume. that included abundant vegetation in Silver Lake and secchi depth transparencies that commonly exceeded 30 inches. Vegetation was largely absent from Silver Lake during the 2006 and 2007 growing seasons and secchi transparency commonly fell below 24 inches. Aquatic macrophytes (primarily coontail and narrow-leaved pondweed) were abundant during the summer of 2009. Increased vegetation can pose a nuisance to recreational fishing, boating, and lake aesthetics; however, the dense vegetation coverage promotes improved water clarity and reduces the abundance of free-floating algae.
- Secchi measurements from the summer of 2009 indicated transparencies from 46-61 inches.
- A TMDL was completed for Silver Lake in the fall of 2008 and brought focus to watershed areas responsible for primary phosphorus delivery. The goal is to form local action committees to address watershed inputs. Following watershed improvements that reduce sediment delivery and phosphorus inputs, the community and biologists are hopeful that phosphorus-rich sediments can be removed from Silver Lake to help reduce problems associated with internal phosphorus loading.

Union Grove Lake (Tama County)

Union Grove is a 105 acre shallow constructed lake owned by the State of Iowa, with a watershed to lake area ratio of 63/1. It has 6,640 acres in the watershed with the vast majority is in private ownership. In the late 1980's the lake was dredged and an in-lake silt and nutrient dike was installed on the north end of the lake. An additional 60 acres was purchased on the south west side of the park and a 10 acre pond was constructed. Union Grove Lake, last dredged in 1990.

- The IDNR is working with local sponsors to develop a plan to improve the lake and water quality conditions. Melody Bro was selected as the Watershed Coordinator; a TMDL is completed, and a watershed assessment is planned for 2009. Union Grove Lake was placed on Iowa's 2004 impaired waters list because of four limitations: pH, bacteria, algae, and turbidity.
- A RASCAL (Rapid Assessment of Stream Conditions Along Length) was completed in 2008. In 2008 the Union Grove watershed received a $37,000 grant for approved soil conservation practices. Another $6,900 was approved for stream back protection and fencing of livestock..
- The Union Grove Lake Watershed Project has been underway since April of 2008. The project aims to reduce the soil and phosphorus reaching the lake by 57%, as well as reduce the effects of livestock on streams in the watershed.
- Spillway water seepage had been an on-going problem at Union Grove Lake. Past attempts to repair the problem were met with limited success.
- IDNR hired a geo-tech firm in 2005 to evaluate the problem and contracted a firm in 2006 to repair the structure.
- They completed the project in July of 2007 and successfully addressed the water seepage issue. Total project cost for the spillway repair was $178,572, with the lake restoration program as the funding source.
- The construction firm also made several recommendations for additional future spillway modifications that will preserve the integrity of the system at an estimated cost of $40,000.

Lake Restoration Program (LRP) – Completed Projects

Crystal Lake (Hancock County)

Crystal Lake is a small 269-acre natural lake in Northwest Iowa with a watershed to lake area ratio of 8.8/1. IDNR completed construction of the dredge spoil site in July 2006 at a cost of $838,000. This

project involved the IDNR acquiring approximately 100 acres of land to mitigate the use of the wildlife area as a containment site. IDNR awarded a contract to dredge and work commenced in October 2006.

- The contractor completed dredging operations in the fall of 2007.
- They removed 1.3 million cu./yds. of sediment at a cost of $3.1 million.
- The DNR modified the spillway structure to prevent carp from re-entering the system.
- In the fall of 2008, the DNR renovated of the fish community of Crystal Lake; they anticipate additional improvements to water quality due to the removal of common carp from the system.
- An aggressive DNR fish stocking program was initiated during the spring 2009 and work was completed to improve boat ramp access.
- The local "Save Iowa's Crystal Lake Group" was nominated and received one of the State of Iowa's 2008 Governor's Volunteer Award for their 10 years of dedicated service and work that they contributed to bring this project to successful completion.
- Eight years of water quality sampling at Crystal Lake prior to the completion of restoration indicated an average Secchi Disk depth of 1.3 feet and an average Total P level of 337 parts per billion. One year of water quality sampling following restoration indicates an average Secchi Disk depth of 6.25 feet and an average Total P level of 104 ppb.

Anticipated Benefits

This small community and the surrounding rural area is an excellent example of a locally driven project that will benefit from lake improvement. Following restoration, improved fishing opportunities alone could add nearly $400,000 annually to the local economy. In addition improved water quality will benefit other water-based recreation. The combination of the watershed and lake improvement work will remove Crystal Lake from the Impaired Waters List and add to the estimated $2.5 million spent annually by lake visitors.

Lake of Three Fires (Taylor County)

Lake of Three Fires Lake is a 96-acre constructed lake with a watershed to lake ratio of 38/1. ISU completed a diagnostic/feasibility study in 2000 and identified a number of restoration alternatives. Watershed work and lake dredging was completed in 2005. The final recommended component of the restoration project was a wetland on the IDNR Simmons Wildlife Area immediately above the lake. This wetland will provide water quality protection and diversify the wildlife area. The wetland project is a cooperative venture in which NRCS will design the project, and IDNR will acquire the additional land necessary for the project, manage project construction and inspection. IDNR utilized lake restoration funding to acquire 80 acres of land at a cost of $185,000 and following the land purchase constructed a wetland at a cost of $95,000. The wetland project utilized 75% Federal 319 funds and 25% State Lake Restoration funds.

Lake of Three Fires (Taylor Co.)

- Lake of Three Fires maintained excellent water quality despite excessive rainfall events, 30% above normal in 2007.
- The fishery and water quality improvements following lake restoration have far exceeded expectations. Fish growth and abundance is high, water clarity exceeds any previous level and park use continues to exceed previous levels.
- Activities at Lake of Three Fires since the 2006 refilling and restocking have centered on completing the fish stocking plan, monitoring water quality parameters, completion of a sediment retention structure, and introducing various desirable aquatic plant species. The current existing fish population is growing fast offering many angling opportunities to the public.
- A sediment-nutrient retention / wetland area was completed on the main arm of the lake in the fall of 2007. The wetland has filled with water and is functioning as designed. Water clarity of water leaving the retention area appears to be as good as or better than that flowing into the lake from unprotected areas.
- Desirable rooted plants have been shown to improve water clarity in other southern Iowa water systems. An effort was begun in 2007 to introduce various plant species to help consume nitrogen and phosphorus. An existing lotus population is expanding and crowding some of the newly introduced species. Progress can be seen in small areas of the lake but extensive new growth in limited. A sampling and monitoring project is underway.
- Plans for the lake are to monitor the water quality, integrity of the silt retention structures, and the growth and or expansion of the plant community. All of these issues will affect the water quality, fish growth, and or public use of the area.

Red Haw Lake (Lucas County)

- In 2001, an additional wetland and three sediment retention ponds were constructed within this watershed to improve and protect water quality.
- Recently IDALS performed a watershed assessment and identified priority gully areas. The District and NRCS require additional assistance in funding for the design and construction of six to eight structures within the State park.
- IJOBS funding for Best Management Practices on Public Land will be used to fund these structures.

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Viking Lake (Montgomery County)

Viking Lake is a 137-acre man-make lake, located within a 1,000-acre state park. Initially impounded in 1957 it has historically been an above-average fishery, however with the introduction of yellow bass approximately 10 years ago, the fishery has dramatically declined. Water quality at the lake has always been average, however following periods of heavy rainfall turbid water conditions could persist for up to two weeks, persistent algal have also been an issue at the lake. A watershed coordinator through the 319 program has implemented corrective measures within the watershed.

Current water clarity condition at Viking Lake have improved to 4 ¾feet during the summer post major restoration efforts.

- IDNR staff identified twenty-two (22) areas near the lake, on or including portions of state property, as needing grade stabilization structures to control soil erosion and improve water quality. Construction of twenty sediment structures is complete.
- IDNR did drain the lake after Labor Day (2006) and renovated the fishery to eliminate the problem yellow bass population.
- In addition, after lowering the lake, they repaired the dam gate, protected the shoreline, constructed jetties, deepened shoreline, and improved angler access and fish habitat.
- Viking Lake returned to full pool during the spring of 2007 and has been restocked with largemouth bass, bluegill, channel catfish, and crappie. The development of the fish population has been rapid and some angling began in 2008.

Lake Restoration Program (LRP) – Projects In Planning / Outreach Stage

Arbor Lake (Poweshiek County)

Arbor Lake (Poweshiek County) is a 13 acre lake owned by the City of Grinnell. It has 979 acres in the watershed in which 75% is urban runoff. The watershed to lake ratio is 75:1. A TMDL study was completed in 2002.

- In 2005 the NRCS received a $150,000 grant to improve the watershed.
  Three wetland complexes were installed and targeted 298 acres of the watershed
  Storm sewer interceptors were installed and controlled another 18 acres.
  Riffle pools were installed on Hazel Creek to reduce erosion and down cutting of the stream. Two acres of native vegetation filter strips were planted along the riffle/pool structures.
  One three acre rain garden was established at the Windsor Assisted Living Complex east of the lake.
- In October of 2009, representatives from the DNR and City of Grinnell along with IOWATER members held a successful and informative meeting regarding Arbor Lake Restoration.
- The group plans to hold a February community meeting to gain interest in Arbor Lake restoration and to explain the community-based process needed to obtain Lake Restoration Program funding.
- The goal is top establish an Arbor Lake Restoration Advisory Council to develop a Management Plan for Arbor Lake. These meetings will be smaller invite-only meetings.

George Wyth Lake (Black Hawk County)

George Wyth is a sand borrow-lake with relatively low overall fertility when compared to other Iowa Lakes due to predominately sand substrates and a “new” lake basin. George Wyth’s fishery is moderate to poor, due to relatively low productivity and a lack of aquatic vegetation. Water quality parameters in George Wyth Lake compare favorably to other Iowa lakes, which can be attributed to a low watershed to lake ratio and relatively small portions of watershed in agricultural production.

- A TMDL was completed for George Wyth Lake in 2008 to address impairment due to high bacteria levels on the beach, with the primary cause for impairment identified as resident geese.
- George Wyth Lake was affected by flooding from the Cedar River in 2008 and the State Park was closed during the period from June 5 to July 25.
- Biologists introduced aquatic macrophytes into George Wyth Lake this year on an experimental basis. Wild Celery and Narrow-Leaved Pondweed were introduced into 2 enclosures and the DNR will monitor the success of these introductions during the next year. If the experimental introductions prove successful, we will expand the plantings during the upcoming years.

Lake Keomah (Mahaska County)

- A public meeting was held to gauge local support for restoration activities at Lake Keomah. The Mahaska County Soil and Water Conservation District applied for a watershed assessment grant to evaluate the status of sheet and rill and gully erosion within the watershed in 2008. However, this grant proposal was not supported. A sheet and rill assessment was completed in 1991; however, it did not include any assessment in the State Park or in Keomah Village, nor did it assess areas within Keomah Village.
- Current activities center on the creation of a "Friends" group for the State Park, laying the groundwork for local support and participation in future restoration activities.

Little River Lake (Decatur County)

Little River Lake is an 800 acre PL-566 multipurpose lake located in Decatur County. The lake was constructed in 1986 and for its first 15 years produced tremendous quantities of quality fish. Common carp, an inadequately protected watershed, and unprotected shoreline problems have reduced water clarity, suppressed sport-fish abundance and growth, recreation opportunities, and increased water treatment costs. Fish quality and angling activity have steadily declined since 2000 to a point where the lake offers few sport-fish or angling opportunities today.

- A coalition of local interested entities formed a restoration committee in 2008. Since that time, the group has met to plan and implement water quality improvement practices for the watershed.
- The Decatur County Soil & Water Conservation District and NRCS personnel assessed the watershed's problems, quantified soil erosion, and identified best management practices, (BMPs). The Decatur SWCD applied for and was awarded a $423,900 Watershed Improvement Review Board (WIRB) grant to cost-share improvement costs with landowners. The group also asked the DNR Lake Restoration Program to consider Little River Lake a priority lake to allow possible funding for in-lake improvement projects.
- Pending adequate implementation of watershed soil conservation practices, Lake Restoration funding may be used to address in-lake improvements such as shoreline stabilization, rough fish management and silt basin improvements.
- The NRCS staff is currently formalizing agreements with landowners and designing BMPs to address sight specific remedies. This portion of the project is expected to continue throughout the winter with construction to begin during the spring of 2010.
- The restoration process from the spring 2010 onward will involve implementation of watershed practices until available WIRB funding is utilized. Continuous re-assessment will then guide planners to remaining areas of the watershed in greatest need. Additional funding will be needed to address remaining areas as well as any in-lake issues.

Mariposa Lake (Jasper County)

- The Mariposa watershed project is set to run through June 2010. One waterway project was completed spring 2009. Work is being completed to install a wetland immediately above the lake on the main feeder stream. Construction of the wetland will likely begin spring 2010.
- The Jasper County Conservation Board has completed bank stabilization practices along approximately 900 ft of shoreline using rock rip rap and coconut fiber logs. Another 500 ft is planned for spring 2010.
- The Jasper County Conservation Board is also working on a 3 acre timberstand improvement project. An area that is overgrown over a gully has been cleared to approximately 25% canopy cover to allow grasses to grow. The area will be seeded to native grasses and wildflowers.

Pleasant Creek Lake (Linn County)

Pleasant Creek (Linn County) is a 401 acre lake owned by the State of Iowa. It has a 2,035 acre watershed in which the State owns 90%. The other 10% is mainly in timber. The watershed to lake ratio is 5:1. One specific concern with this lake is shoreline erosion. DNR staff has documented approximately five miles of shoreline that needs stabilized along with many shallow areas that need to be deepened. Their may be some opportunity to do some gully control structures on park property and review and update land management approaches on state ground. DNR Fisheries and Parks are working cooperatively with IDALS to developing a plan to address these problems.

Lake Restoration Program (LRP) – Other Program Activities

Meetings with Local Leaders and Stakeholders

In accordance with Section 26 of House File 2782: "The department shall meet with representatives of communities where lakes on the initial list are located to provide an initial lake restoration assessment and to explain the process and criteria for receiving lake restoration funding".

The IDNR has established local stakeholder groups or held initial technical field staffs planning. We have had these discussions with a number of active or planned lake/watershed improvement projects. Including; Big Creek Lake, Blackhawk Lake, Carter Lake, Clear Lake, Easter Lake, Green Valley, Lake Darling, Lake Geode, Lake Manawa, Lake Wapello, Lizard Lake, Lost Island Lake, Lower Gar Lake, Prairie Rose Lake, Rathbun Lake, Rock Creek Lake, and Storm Lake.

<u>Potential Future Projects that need Meetings with Local Leaders and Stakeholders:</u>
Central Park Lake (Jones Co.), Diamond Lake (Poweshiek Co.), Hannen Lake (Benton Co.), Kent Park Lake (Johnson Co.).

Lake Restoration Prioritization Process

The Lake Restoration Program initially ranked 131 public lakes for lake restoration priorities in 2006. A group of thirty-five lakes, considered highest priority for restoration, was established and serves as a starting point for identifying potential lake restoration projects. Ranking indices used lake water quality data and watershed characteristics to create groups of good, fair, or poor lakes and watersheds. The department used these descriptions to categorize lakes into management action groups.

IDNR will periodically review the list of thirty-five lakes annually to determine which lakes should proceed with lake restoration. Until watershed best management practices protect the lake, restoration work cannot move forward, therefore lakes with well-documented watershed protections are the best candidates for restoration.

The other necessary ingredient to begin lake restoration is local commitment. In order to better document how lake restoration will benefit Iowa we will use cost benefit analysis, as well as identifying non-economic benefits to people and our natural resources. Computing and documenting the economic benefits, recreation benefits, health benefits, and natural resource/environmental benefits of lake improvements will be a great asset to the lake restoration process. This information will also go a long way in communicating the need of lake restoration projects to local communities and the legislature.

Inquiries from Stakeholders of Lakes not on the Priority List

Also in accordance with HF2782, "Communities with lakes not included on the initial list may petition the director of the department for a preliminary lake restoration assessment and explanation of the funding process and criteria".

During the first half of FY08, local stakeholders of Lake Rathbun (Appanoose Co.), Lost Island Lake (Palo Alto Co.) and Summit Lake (Union Co.) contacted the IDNR to consider their respective lakes for a restoration project. Rathbun Reservoir (Appanoose Co.) is a 11,000 acre lake in south-central Iowa that is one our most significant state recreational destinations. It is distinct from several of our other large reservoirs, Saylorville, Coralville and Red Rock in that its watershed to lake ratio is only 37:1 and has great potential to maintain and improve lake water quality with a combination of watershed and lake restoration alternatives. Lost Island Lake (Palo Alto Co.) is a 1,000 ac. natural lake in northwest Iowa that is not meeting its water quality and recreational potential. The Iowa IDNR currently owns 23 percent of the watershed and proposes a watershed assessment of the entire system.

Several additional restoration projects have been included in the program: Meadow Lake (Adair Co.), Hawthorn Lake (Mahaska Co.) and Little River Lake (Decatur Co.). Meadow Lake will require less than $100K from the LR Program and Section 319 Program to achieve success; Hawthorn Lake will utilize WIRB and LRP funding to complete the project; Little River Lake will also be included into the program; however, in-lake work is several years off and will require significant watershed improvements before the in-lake work can begin.

Three lake restorations projects were denied entry into the LR Program: Sands Timber (Taylor Co.), South Twin Lake (Calhoun Co.), and Summit Lake (Union Co.). For South Twin Lake the DNR recommends shallow lakes management with no dredging. The DNR is working cooperatively with local groups at Summit Lake to assist in a technical capacity and to help fund efforts associated with the ability to drain Summit Lake, future elimination of rough fish from the system and modification of the spillway to prevent migration of these fish back into Summit Lake. The City of Creston recently applied and was successful in obtaining a WIRB Grant top fund $493,117 of a $678,590 project. The WIRB project will focus on watershed improvements, streambank and lake shoreline stabilization and stormwater improvements.

Local, State and Federal Partnerships

In order to achieve lake restoration goals it is critical that the IDNR form effective watershed partnerships. This includes partnerships at the local level, but also at administrative levels of government. Local, state and federal programs offer a multitude of programs for financial assistance to landowners for soil conservation and other water quality protection practices. The strategy pursued in the lake restoration program will be to seek out key individuals with expertise at the local level and the program administration level. This expertise will maximize access to financial incentives for landowner participation in watershed improvement and lake restoration projects. Listed below are several examples of potential partners in watershed improvement and lake restoration.

<u>Local:</u>

- Chamber of Commerce
- City/Town Mayors and Councils
- Conservation and Recreation Clubs and Organizations
- County Board of Supervisors
- County Conservation Board
- IDNR Field Offices (Environmental Services, Fisheries, Forestry, Parks, Wildlife)
- IDALS/ Division of Soil Conservation – Project Coordinators
- IOWATER Volunteers / Educators / Interested Citizens
- Lake Associations / Groups
- NRCS Soil and Water Conservation Districts (SWCD)
- Private Landowners
- USDA Resource Conservation and Development (RC&D)
- Watershed Organizations

State:

- Agribusiness and Community Organizations
- IDALS/ Division of Soil Conservation
- Iowa Department of Transportation
- Iowa Environmental Council
- Iowa Farm Bureau
- Iowa Natural Heritage Foundation

Federal:

- U. S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers
- U.S. Geological Survey

Communication Tools and Strategies

The IDNR, in cooperation with Iowa Department of Agriculture Land Stewardship (IDALS), has worked to develop a holistic approach to locally led watershed projects. The Watershed Improvement Review Board has adopted it as the basic planning requirement for successful proposals.
The IDNR website includes the current 9-step planning protocol:
http://www.iowaIDNR.gov/water/watershed/files/protocolguide.pdf

The group is developing a brochure (small enough to fit in your shirt pocket) that outlines how the protocol works and identifies where the public fits into the process. People will find these brochures useful as handouts at meetings. In addition to brochure type handouts, a number of communication and outreach tools for the public and lake stakeholders will be considered as deemed appropriate, including: display/kiosk, lake restoration tool kit and workshop, newsletters, opinion surveys, web site. For example, the Lakes Program developed a one-page handout that summarizes the Lake Restoration Process. This has proved to be a useful tool in communicate the important aspects of the program to the public (Appendix D).

Several brochures are available on-line that offer more information about lake restoration and watershed improvement.

- Lake Darling
  http://www.iowadnr.gov/water/nonpoint/files/darling.pdf
- Lake of Three Fires
  http://www.iowadnr.gov/water/watershed/3fires_success.html

Shallow Lakes Management Initiative

Ducks Unlimited and the Iowa DNR's Wildlife and Fisheries Bureaus established a prioritized list of at least 50 shallow lakes to be renovated over the next ten years. The first lake to be renovated was Diamond Lake in Dickinson County. Renovation work began during summer 2006. Shallow lakes prioritized for restoration include; Dan Green Slough in Clay Co., Four-Mile Lake in Emmet Co., Pickerel Lake in Buena Vista Co., South Twin Lake in Calhoun Co., Virgin Lake in Palo Alto Co., and Lizard Lake in Pocahontas County.

The following excerpt, provided by Joe Larscheid, DNR Fisheries, describes the basis and objectives for the DNR's Shallow Lakes Management Initiative.

"Shallow lake management has always been a challenge in Iowa and around the world. Shallow lakes are scattered throughout Northwest Iowa and, in most of these lakes water quality lakes is less than

desired. In fact, most of these lakes are turbid, algae-dominated systems with little to no vegetation, and poor sport fisheries comprised mostly of common carp (Cyprinus carpio), and black bullheads (*Ameiurus melas*). Successful restorations of deeper lakes have historically focused on reducing nutrient inputs by repairing the watershed and/or removing phosphorus-laden sediments from the lake. Successful shallow lake management strategies require intensive in-lake management strategies that can immediately flip the basin from the turbid-water state to the clean-water state, and long-term watershed protection efforts that help maintain clean water over time."

Shallow lakes differ substantially from deeper lakes in many respects (Scheffer 1998). Shallow lakes usually exist in either of two alternative stable trophic states with or without any change in the nutrient budget of the lake (Scheffer et al., 1993, Moss et al., 1996). These lakes can exist as very turbid, algae-dominated systems with little to no vegetation, or as clear water, macrophyte dominated systems. In shallow lakes, the benthivorous and planktivorous fishes along with wind and wave action and in some cases heavy boating traffic can perpetuate the algae dominated system.

By controlling or removing the factors perpetuating the algae dominated turbid system, it is possible to "flip" the system into a clear water macrophyte dominated system (Scheffer, 1993). The positive impacts of emergent and submergent vegetation on water quality are due to several factors. Rooted vegetation prevents resuspension of sediments into the water column by solidifying bottom sediments and suppressing wind and wave action. Rooted plants provide habitat for periphyton and zooplankton and fish species commonly found in clear water lakes. Rooted vegetation also ties up nutrients making them unavailable for algae. Some plants also release allelopathic substances into the water suppressing algae growth. Many of these mechanisms are difficult to assess and vary among water bodies; however, their combined effect stabilizes the clear water trophic state (Scheffer et al., 1993). Both the clear water macrophyte state and the algae dominated state are stable, and it takes a major perturbation to move from one state to another (Scheffer et al., 1993). Three methods that show great promise to cause the shift from the turbid to the clear water state are benthivorous fish control, heavy piscivore stockings (to control both benthivorous and planktivorous fishes), and water level draw downs (Scheffer et al., 1993). The goal of this project is to develop tools that managers can use to shift and maintain shallow lakes in a clear water state.

Shallow Lakes Management Project Components:

- Shallow lake renovation based on alternative stable trophic states: Management guidelines that cause shallow lakes to shift from the turbid, algae -dominated systems to the clear, macrophyte-dominated systems.
- Physical characteristics of shallow lakes before and after restoration: Characteristics include information about the watershed, bathymetry, sediment profile, and water chemistry of the lakes.
- Biological characteristics of shallow lakes before and after restoration: Characteristics include the plankton, macrophyte, fish community and waterfowl use of the assessed lakes and the related changes to benthivorous fishes from biomanipulation of these biological components.

Update on Shallow Lake Projects using Lake Restoration Funds, December 2008

Introduction: Natural Lakes in Northwest Iowa are mainly characterized as shallow, wind swept systems that exhibit poor water quality. Significant watershed changes and the introduction of common carp in the late 1800's have forever made management of these water bodies a challenge. Through work accomplished on the projects listed below, great strides have been made in our understanding of these systems. These ground breaking projects in Iowa will undoubtedly lead to others as the health to these unique water bodies is restored. Success is also being measured in public education and outreach, communities and user groups are coming together to make these projects truly successful demonstration models for improving not only water quality, but fostering partnerships for the long-term active management required to maintain the health of these lakes.

The current focus of the Lake Restoration Program is on shallow lakes that support both fishing and wildlife benefits. In addition, there is an emphasis on shallow systems above important natural lakes.

Center Lake, Dickinson County – Due to strong local support, the damaged and ineffective Center Lake outlet culverts were replaced at a lower elevation with a variable-crest concrete water control structure during fall 2008. Improvements to in-lake and downstream outlet channels were also completed. Collectively, these improvements will reduce flooding impacts on the 264-acre Center Lake and will allow for beneficial partial drawdowns on Center Lake and two associated Type III wetlands. Establishment of aquatic vegetation in the lake and wetlands will improve fish and wildlife habitat and will enhance water quality in Center Lake and its downstream neighbor, West Lake Okoboji.

This work on the lake outlet is only a small part of a comprehensive plan being developed for this lake. Storm water modeling and prioritization of other watershed inputs are underway. The Center Lake Improvement and Protection Association has collaborated with local agencies to develop a lake restoration plan to reverse recent declines in water quality and received a $15,000 local grant to cost-share improvements to the outlet.

Dan Green Slough, Clay County – The donation of a key tract of land in 2008 facilitated the installation of a pump system and fish barrier on the 311-acre Dan Green Slough during fall 2008 and winter 2008-09. A subsequent temporary draw down of the basin during spring and summer 2009 resulted in the eradication of rough fish, the consolidation of bottom sediments, and the re-establishment of over 250 acres of soft stem bulrush and other beneficial emergent aquatic plants. The basin will be kept partially dry during the 2010 growing season to allow for the continued growth of emergent vegetation and the establishment of submergent plants. Weather pending, the basin will be brought to full pool during fall 2010 or spring 2011.

Diamond Lake, Dickinson County - During winter 2006-07, the initial efforts to enhance this 166-acre basin were completed with the installation of a drawdown tile designed to allow the lake to be periodically dewatered to eliminate rough fish and to allow for the germination of aquatic plants and consolidation of bottom sediments. Excessive rain in late summer 2007 prevented a successful drawdown. A winter rotenone project in January 2008 eliminated the few remaining rough fish in the lake. A successful drawdown was realized in summer 2008 through the continuous use of the drawdown tile and the temporary use of an auxiliary diesel pump, which was purchased with Lake Restoration funds. The outlet of the lake was also lowered about 0.5' to a more natural elevation, which will prevent excessive shoreline erosion, tree toppling and should provide for water levels more conducive to aquatic plant growth. Despite a cool spring, regrowth of vegetation did well over the summer.

Aerial photo with Diamond Lake at approximately half pool.

Diamond Lake water clarity post renovation

A “reef” fish barrier was installed during winter 2008-09 to prevent the reinfestation of rough fish into Diamond Lake. The barrier is best described as a flow-through rock weir. At present, the lake contains exceptionally clear water and has diversified stands of emergent vegetation on the lake’s perimeter and submergent vegetation within the lake. Migratory bird use has been excellent with several thousand shore birds and waterfowl observed on the lake during early fall 2009. Fingerling yellow perch were stocked spring 2009 and northern pike will be stocked in 2010. Weather permitting, the basin will be brought to full pool during spring 2010.

Four Mile Lake, Emmett County – A partial drawdown initiated during summer 2008 allowed for the successful addition of a fish barrier and in-lake drawdown channels in Four Mile Lake during fall 2008. Continuation of the drawdown summer 2009 allowed for the eradication of rough fish, the consolidation of bottom sediments, and the establishment of beneficial submergent and emergent vegetation in the 200-acre basin. Presently, the basin is at full pool, contains very clear water, supports robust populations of submerged plants and associated invertebrate populations, and provided excellent migratory bird habitat. It is expected that during spring 2010, the restored Four Mile Lake will fulfill its intended function of becoming a “stepping stone” lake by providing exceptional migratory habitat for diving ducks and other migratory waterbirds that rely on healthy aquatic environments to complete their life cycles.

Jemmerson Slough, Dickinson County - Located at the top end of an important West Lake Okoboji watershed, the 932-acre Jemmerson Slough complex is an important water quality, wildlife habitat, and public recreation/education area. In 2006, Phase I of the Jemmerson Slough Enhancement Project was completed with the installation of two water control structures and two outlet improvements. During fall 2008, the second and final phase was completed with the installation of a pump station, new gravity-flow water control structure, and fish barrier. Intensive efforts were made during construction to prevent water quality problems in West Lake Okoboji and other downstream basins. Jemmerson Slough was temporarily dewatered during summer 2009 to rid the basin of rough fish and to allow for the re-establishment of aquatic emergent vegetation like soft stem bulrush, cattails, and other important plants. In 2010 water levels will be brought up slowly to promote the continued growth of existing emergent plants and to

provide a favorable environment for the growth of beneficial submergent plants like sago pondweed. Once re-hydrated, over 200 wetland acres will send cleaner water to West Lake Okoboji and other downstream basins, and will provide excellent production and migratory wildlife habitat.

Lizard Lake (Pocahontas County) - Lizard Lake is a 285-acre shallow natural lake. Rough fish (buffalo, bullhead and carp) dominate the lake population. The lake contains very little area of aquatic vegetation and exhibits poor water quality. A local lake group has promoted lake restoration and they continue to meet with IDNR staff to discuss their concerns. In June 2006, IDALS and the local Soil and Water Conservation District awarded a Development Grant to evaluate the watershed of Lizard Lake.

Iowa State University Limnology Laboratory conducted a Diagnostic Feasibility study for Lizard Lake. As part of potential restoration alternatives, ISU presented "shallow lakes management" as an option for improving the lake's water quality, fish population structure and wildlife potential. During 2008 and 2009, IADNR staff has met several times with local partners and stakeholders to discuss shallow lake management options for Lizard Lake. Many stakeholders recognize the benefits of shallow lake management and expressed a preference for that type of management. Other stakeholders, while preferring dredging, realize that high dredging costs make that option unattainable and therefore support shallow lake management. Other stakeholders preferred to continue supporting dredging as the only alternative. Due to relatively strong support from most local constituents, the DNR has hired Ducks Unlimited to conduct survey work during winter 2009 and plans to construct a water control structure and fish barrier during fall and winter 2010 – 11.

Related Activities and Studies

Economic Impact and Value of Preserving and Restoring Water Quality in Iowa's Lakes

Project Summary and Update: Iowa State University
Joseph A. Herriges, Catherine L. Kling, Daniel M. Otto, and Subhra Bhattacharjee,

The purpose of this project work is to provide the Iowa Department of Natural Resources with information on the economic impact generated by Iowa lakes for local communities and to provide ongoing visitation information to assess the changes in usage that Iowans have made to Iowa lakes in response to changes in water quality and the cost of accessing the lakes. This information will contribute to the cost-effective management of lake restoration projects.

Two primary sources of data are being collected to provide the needed information. First, on-site expenditure data has been collected for three lakes in Iowa: Clear Lake, Pleasant Creek Lake, and Lake Manawa. These intercept surveys were undertaken in the summer of 2009 and summaries of the information collected are provided in Tables 1-7. A total of 141 completed intercepts were collected from Clear Lake, 132 from Pleasant Creek, and 72 from Lake Manawa. Additional intercept surveys will be undertaken in the spring and summer of 2010 to increase representativeness of the samples, to extend the time period covered and to collect additional data concerning whether the intercepted households resides within or out of the state of Iowa.

We gathered information from the intercept surveys on the different activities intercepted households engaged in while on site. Table 1 summarizes the reasons reported for visiting each of the target lakes. Note that the total percentages do not sum to 100 because respondents were asked to indicate all activities undertaken. Table s reports the percentage indicating that they were single vs. multiple day visitors. Since the intercepts at Clear Lake were done largely at the campground, the majority of intercepted households indicated a multiple day visit. Multiple day visitors were also heavily sampled at Peasant Creek Lake and Lake Manawa. Table 3 reports the average number of trips made by the intercepted households and Table 4 reports group sizes.

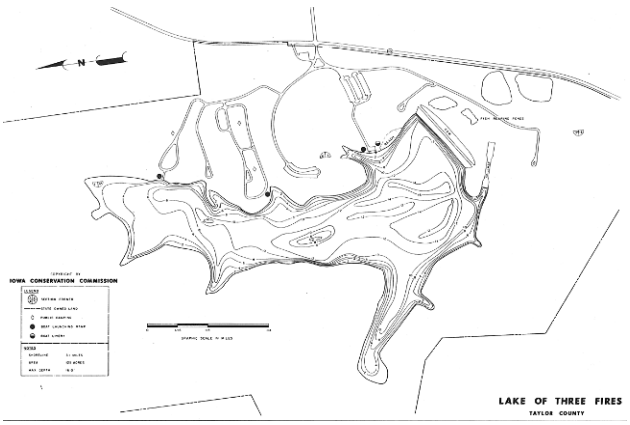
To understand how expenditure patterns may vary across different types of lakes, we collected spending data for each of the three lakes across several major categories: supplies, food and beverage, gas and care expenses, lodging, shopping, and entertainment. Tables 5, 6, and 7 report the average expenditures in these categories from the intercepted households as well as the standard deviation, maximum and minimum reported values. The last set of expenditure data in each table summarizes the total spending patterns. As expected, there are notable differences in spending patterns across the different lakes, both in total and by expenditure category. The average single day trip from Clear Lake is associated with a $93 expenditure, while multiple day trips result in expenditures of nearly $350/trip. In contrast, the comparable numbers for Pleasant Creek are much lower --- $64/trip for single day visits and about $180/trip for multiple night visits. The reported expenditures for Lake Manawa are more similar to Clear Lake for single day trips at $85/trip, but the multiple day trips exhibit expenditure magnitudes more similar to those seen at Pleasant Creek.

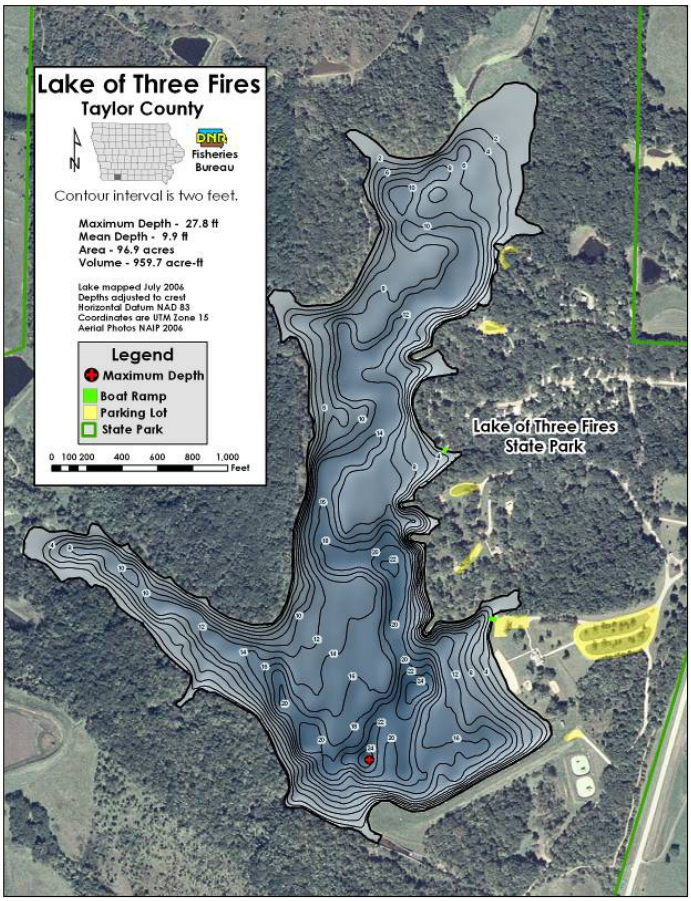
As noted, 7500 total surveys were sent out, of those, about 2500 have now been returned (after a post card reminder was sent about 2-3 weeks after the initial mailing). Given the over 500 nondeliverables, this has resulted in a response rate of about 35%. As soon as the holidays are over, the nonrespondents will be sent another copy of the survey with a letter requesting that they complete it. This final mailing typically results in another 10-15 percent return rate.
The survey work is largely on schedule and data entry and analysis should begin in midspring as described in the original work plan.

Statewide Bathymetric Lake Mapping

The last major effort to map Iowa's lakes began in the early 1970's. Managers relied upon these early contour (bathymetric) maps to guide restoration efforts, calculate water volumes and basin characteristics, and assist recreational users. Lakes go through many changes during their lifespan, and over the past 30 years silt deposition has profoundly changed many lakes in Iowa. Older maps, in many cases, have simply become obsolete. Additionally, many of Iowa's new lakes are not mapped. Since the 1970's, there have been significant technological advances leading to improvements in map accuracy and utility. Our current mapping efforts are utilizing state-of-the-art electronics and map generating software. This effort, including maps and the underlying data, provides a fundamental tool needed by communities and resource professionals to make important lake management decisions.

The Iowa Statewide Lake Mapping Project designs maps around a standard set of methods developed over the past three years. Data acquisition began in 2006, since the first season, 92 lakes having been mapped. Currently there are 76 maps available to the public with additions becoming available every couple months. This year data was collected from all four districts in Iowa in order to support planned restoration projects. Groundwork was also laid down to support mapping efforts in the future by establishing elevation benchmarks near those lakes with no known outlet or ordinary high water elevation.





This technology can be used to provide a very clear and accurate view of a lake before, during and after a sediment removal project. This allows managers to guide renovation efforts along the way, giving them far more control and satisfaction with the end product. By having a clear baseline before a dredging project begins, managers can be certain that the terms of their contract with sediment removal companies have been honored and payment can be made accordingly.

A combination of shaded models, aerial photography, and contour lines creates one final product, the contour map. Public amenities, such as boat ramps, parking areas, and park and public land boundaries are added and labeled. The lake mapping specialist adds a legend before sending the map to lake managers for edits and comments. Finally, the map is ready for public use and distribution to field offices and our website. The combination of new data with aerial photography provides the public with a much improved product. This year each of the 76 published maps were updated to provide a consistent design and a much improved compression method that will improve access to online users. Working with ITB, many new web pages are being developed in order to showcase and make available all maps currently completed.

In addition to a better visual product, this data will have uses in research that will benefit the Lake Restoration Program and its many partners. The new lake data and maps will become a very accurate and useful historical record for future lake management. In many cases, comparison of as-built contours to present day bathymetry can provide information of historical sedimentation rates and identify the areas of a lake most affected by sedimentation. By returning to lakes in subsequent years, we can monitor sedimentation rates and evaluate the effectiveness of sediment control practices and structures. In the end, the statewide lake mapping program has far reaching effects; it supports not only lake restoration, but fisheries managers, wildlife units, floodplain managers, NRCS staff, pollution control specialists and, of course, the Iowa angler.

Determining Historic Water Quality Conditions in Iowa Natural Lakes

Principal Investigator: John Downing
Student Investigator: Adam Heathcote (Ph. D.)

Introduction
This project aims to provide the Iowa Department of Natural Resources with baseline values of total phosphorus nutrient concentrations in Iowa's 34 natural lakes of recreational importance. This will yield a clear understanding of the amount of disturbance that has taken place since human settlement and assist in the setting of realistic standards for lake restoration, remediation and nutrient impaired reference conditions. This will be an improvement on current reference conditions, which are determined indirectly

and do not consider historical information. In addition to providing information on these lakes, this work will set the stage for hind-casting water quality conditions for other lentic ecosystems in the state.

Goals and Objectives:

- Determine total phosphorous levels and sedimentation rates that existed prior to European settlement in Iowa (ca. 1850) along with their level of precision.
- Use determined total phosphorus levels and sedimentation rates to: (A) aid in the setting of benchmarks for lake restoration; (B) provide quantitative historical information on pre-European status of natural lakes included in the Project; and (C) provide the DNR with clear reference conditions for the minimally disturbed condition of lacustrine ecosystems within the state.
- Determine eutrophication rates in Iowa's natural lakes via fluxes in sedimentation and nutrient levels, prior to and since European settlement, to evaluate the impact of land-use changes within the lakes' watersheds.
- Develop the necessary technology (a diatom transfer function) from current environmental conditions and species assemblages unique to Iowa and inclusive of conditions and assemblages hypothesized to have historically existed in the state.

Benchmarks of Biological Integrity for Lake Restoration Success: Fish Assemblage and Population Dynamics in Iowa Lakes

Submitted by: Jesse Fischer and Michael Quist
Period: July 1 – September 31, 2009

During this quarter, fall sampling began on 13 lakes and impoundments (i.e., Ahquabi, Easter, Rock Creek, Union Grove, Hickory Grove, Diamond, Big Creek, Carter, Manawa, Blue, East Okoboji, Spirit, and Lower Gar) throughout the state. Fall sampling consisted of night electrofishing and fyke netting. In addition to fall sampling, trawling was conducted on all 13 lakes during the summer (i.e., late June – mid July). All fish sampled were measured to the nearest millimeter and fish greater than 100 mm were weighed. Hard structures (e.g., scales, spines) are being collected from several fish species (i.e., common carp, black bullhead, black crappie, bluegill, largemouth bass, and walleye) for aging. Ten of the 13 lakes have been sampled this fall and over 3,000 structures have been collected. Sampling of the remaining three lakes will be concluded by the end of October. Additionally, the fishes from summer trawling were too numerous to count and identify in the field. Therefore, they are being processed in the laboratory. During the next quarter, data will be entered and summarized for all sampling conducted during 2009. Additionally, aging structures will processed, aged, and aging data will be entered into databases for continued data analysis. After analysis, preparations for sampling in 2010 will begin.

Related Monitoring and Assessment

Ambient Monitoring

The Iowa Lakes Survey project (2000-2009) conducted by both Iowa State University (ISU) Limnology Laboratory and the University Hygienic Laboratory (UHL) has provided invaluable water quality data and other information from the 131 Significant Publicly-Owned Lakes (SPOL) in Iowa. Sampling data and other summarized information about survey lakes are available on the internet at http://limnology.eeob.iastate.edu/lakereport/. Funding support for ambient lake monitoring comes from the IDNR Water Monitoring Program through annual appropriations of the State's Infrastructure Environment First Fund and the Lakes Restoration Program.

Ambient lake monitoring data provide the basis for evaluating status and trends in lake water quality and assessing compliance with water quality standards protecting designated beneficial uses. For example, development of a lake classification system used the 2000-2005 lake survey as the basis to prioritize lakes for restoration. Looking ahead, the data will be invaluable as an historical record of water quality to measure progress in water quality improvement.

Field crews monitor the lakes for basic water chemistry, nutrients, chlorophyll, phytoplankton and zooplankton at least three times during the spring and summer. Additionally, researchers construct a temperature profile for each lake to determine the thermocline and the oxygen content along the temperature profile. Past lake monitoring also includes testing for common herbicides, insecticides and metals in both the water and lake sediments. Sampling of lake water quality was coordinated with and augmented by the collection of fish data.

Appendix A. House File 2782 - Enrolled

PAG LIN
1 1 HOUSE FILE 2782
1 2
1 3 AN ACT
1 4 RELATING TO AND MAKING APPROPRIATIONS TO STATE DEPARTMENTS
1 5 AND AGENCIES FROM THE REBUILD IOWA INFRASTRUCTURE FUND,
1 6 ENVIRONMENT FIRST FUND, TOBACCO SETTLEMENT TRUST FUND,
1 7 VERTICAL INFRASTRUCTURE FUND, THE ENDOWMENT FOR IOWA'S
1 8 HEALTH RESTRICTED CAPITALS FUND, THE TECHNOLOGY REINVEST-
1 9 MENT FUND, THE ENDOWMENT FOR IOWA'S HEALTH ACCOUNT, THE
1 10 PUBLIC TRANSIT INFRASTRUCTURE GRANT FUND, THE IOWA GREAT
1 11 PLACES PROGRAM FUND, AND RELATED MATTERS AND PROVIDING
1 12 IMMEDIATE, RETROACTIVE, AND FUTURE EFFECTIVE DATES.
1 13
1 14 BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF IOWA:

31 13 Sec. 26. NEW SECTION. 456A.33B LAKE RESTORATION PLAN AND
31 14 REPORT.
31 15 1. It is the intent of the general assembly that the
31 16 department of natural resources shall develop annually a lake
31 17 restoration plan and report that shall be submitted to the
31 18 joint appropriations subcommittee on transportation,
31 19 infrastructure, and capitals and the legislative services
31 20 agency by no later than January 1 of each year. The plan and
31 21 report shall include the department's plans and
31 22 recommendations for lake restoration projects to receive
31 23 funding consistent with the process and criteria provided in
31 24 this section, and shall include the department's assessment of
31 25 the progress and results of projects funded with moneys
31 26 appropriated under this section.
31 27 The department shall recommend funding for lake restoration
31 28 projects that are designed to achieve the following goals:
31 29 a. Ensure a cost=effective, positive return on investment
31 30 for the citizens of Iowa.
31 31 b. Ensure local community commitment to lake and watershed
31 32 protection.
31 33 c. Ensure significant improvement in water clarity,
31 34 safety, and quality of Iowa lakes.
31 35 d. Provide for a sustainable, healthy, functioning lake
32 1 system.
32 2 e. Result in the removal of the lake from the impaired
32 3 waters list.
32 4 2. The process and criteria the department shall utilize
32 5 to recommend funding for lake restoration projects shall be as
32 6 follows:
32 7 a. The department shall develop an initial list of not
32 8 more than thirty=five significant public lakes to be
32 9 considered for funding based on the feasibility of each lake
32 10 for restoration and the use or potential use of the lake, if
32 11 restored. The list shall include lake projects under active
32 12 development that the department shall recommend be given
32 13 priority for funding so long as progress toward completion of
32 14 the projects remains consistent with the goals of this
32 15 section.
32 16 b. The department shall meet with representatives of
32 17 communities where lakes on the initial list are located to
32 18 provide an initial lake restoration assessment and to explain
32 19 the process and criteria for receiving lake restoration
32 20 funding. Communities with lakes not included on the initial
32 21 list may petition the director of the department for a
32 22 preliminary lake restoration assessment and explanation of the
32 23 funding process and criteria. The department shall work with
32 24 representatives of each community to develop a joint lake
32 25 restoration action plan. At a minimum, each joint action plan
32 26 shall document the causes, sources, and magnitude of lake

impairment, evaluate the feasibility of the lake and watershed restoration options, establish water quality goals and a schedule for attainment, assess the economic benefits of the project, identify the sources and amounts of any leveraged funds, and describe the community's commitment to the project, including local funding. The community's commitment to the project may include moneys to fund a lake diagnostic study and watershed assessment, including development of a TMDL (total maximum daily load).

c. Each joint lake restoration plan shall comply with the following guidelines:

(1) Biologic controls will be utilized to the maximum extent, wherever possible.

(2) If proposed, dredging of the lake will be conducted to a mean depth of at least ten feet to gain water quality benefits unless a combination of biologic and structural controls is sufficient to assure water quality targets will be achieved at a shallower average water depth.

(3) The costs of lake restoration will include the maintenance costs of improvements to the lake.

(4) Delivery of phosphorous and sediment from the watershed will be controlled and in place before lake restoration begins. Loads of phosphorous and sediment, in conjunction with in=lake management, will meet or exceed the following water quality targets:

(a) Clarity. A four=and=one=half=foot secchi depth will be achieved fifty percent of the time from April 1 through September 30.

(b) Safety. Beaches will meet water quality standards for recreational use.

(c) Biota. A diverse, balanced, and sustainable aquatic community will be maintained.

(d) Sustainability. The water quality benefits of the restoration efforts will be sustained for at least fifty years.

d. The department shall evaluate the joint action plans and prioritize the plans based on the criteria required in this section. The department's annual lake restoration plan and report shall include the prioritized list and the amounts of state and other funding the department recommends for each lake restoration project. The department may seek public comment on its recommendations prior to submitting the plan and report to the general assembly.

Appendix B. Significant, Publicly-owned Lakes - Defined

Bachmann (1980). "Clean Lakes Classification Study of Iowa's Lakes for Restoration".
Authors: Roger W. Bachmann, Mark R. Johnson, Marianne V. Moore, Terry A. Noonan

Iowa Cooperative Fisheries Research Unit
Iowa State University, Department of Animal Ecology

Introduction
Approximately 175 lakes and reservoirs were considered by the Iowa Conservation Commission (ICC) staff for inclusion into the list of lakes to be surveyed and classified. Many of these 175 lakes are contained in "Iowa Fishing Guide", a publication of the ICC. Time and money precluded survey and classification of all the lakes; therefore, the list was reduced to include only significant lakes in public ownership.

Significant Lakes – Defined and Explained
Significant publicly-owned lakes were defined as those lakes which are principally maintained for public use containing a minimum surface area of 10 acres and capable of supporting fish stocks of at least 200 pounds per acre. Species diversity in water bodies containing less than 10 acres is habitually low resulting in a fish density with minimal potential for maximum sustained yields via sport or foodfish fisheries. Shallow lakes, which are most characteristic of wetlands and marsh-like habitat that are subject to chronic and extensive fish winterkills, were excluded from the survey. Establishment of productive fish populations is hopeless where massive mortality results from the lowering of life supporting oxygen concentrations under ice cover each winter. Federal-owned onstream impoundment constructed for floodwater supplies were excluded because of Clean Water Act regulations. Multi-purpose lakes providing domestic water supply as only one of several major management objectives were included in the study. Impoundments containing a watershed to surface area ration greater than 200:1 acres were omitted from the list since they are mainly onstream impoundments formed by lowhead dams and emulate riverine habitat rather than lake environment.

Section 305 (b) report (2000)

Section 314 (a) (2) of the federal Clean Water Act of 1987 requires each state to include in it's biennial Section 305 (b) report specific information on the water quality conditions and trends of the state's "significant, publicly-owned lakes," as well as a description of the state's lake protection and restoration programs. In Iowa, "significant, publicly-owned lakes" are defined as those publicly-owned lakes that meet all of the following criteria:

- are maintained principally for public use;
- are capable of supporting fish stocks of at least 200 pounds per acre;
- have a surface water area of at least 10 acres;
- have a watershed to lake surface area ratio of less than 200:1;
- are not shallow marsh-like lakes, federal flood control impoundments, or used solely as water supply reservoirs.

As such, the 115 significant, publicly-owned lakes (SPOLs) represent a subset of the Iowa's approximately 5,400 lakes, ponds, and reservoirs.

Appendix C. Significant, Publicly-owned Lakes

Initial list of thirty-five significant publicly-owned lakes prioritized for funding based on the feasibility of each lake for restoration and the use or potential use of the lake, if restored. The list included lake projects under active development that the department recommended be given priority for funding so long as progress toward completion of the projects remained consistent with the goals of the program.

LAKE NAME	COUNTY
Arbor Lake	POWESHIEK
Big Creek Lake	POLK
Black Hawk Lake	SAC
Blue Lake	MONONA
Brushy Creek Lake	WEBSTER
Carter Lake	POTTAWATTAMIE
Central Park Lake	JONES
Clear Lake	CERRO GORDO
Crystal Lake	HANCOCK
Diamond Lake	POWESHIEK
Easter Lake	POLK
Five Island Lake	PALO ALTO
George Wyth Lake	BLACK HAWK
Green Valley Lake	UNION
Hannen Lake	BENTON
Hickory Grove Lake	STORY
Kent Park Lake	JOHNSON
Lake Ahquabi	WARREN
Lake Anita	CASS
Lake Darling	WASHINGTON
Lake Geode	HENRY
Lake Keomah	MAHASKA
Lake Macbride	JOHNSON
Lake Manawa	POTTAWATTAMIE
Lake of the Hills	SCOTT
Little Wall Lake	HAMILTON
Lower Gar Lake	DICKINSON
Pleasant Creek Lake	LINN
Prairie Rose Lake	SHELBY
Red Haw Lake	LUCAS
Rock Creek Lake	JASPER
Silver Lake	DELAWARE
Storm Lake	BUENA VISTA
Union Grove Lake	TAMA
Viking Lake	MONTGOMERY

Appendix C. Significant, Publicly-owned Lakes

The following lakes were not included on the initial list of thirty-five significant publicly-owned lakes prioritized for funding. They have since been added to the priority list after communities have successfully petitioned the director of the department or were prioritized by the department based on the feasibility of the lake for restoration and the use or potential use of the lake, if restored.

LAKE NAME	COUNTY
Hawthorn Lake	MAHASKA
Lake of Three Fires	TAYLOR
Lake Wapello	DAVIS
Little River Lake	DECATUR
Lost Island Lake	PALO ALTO
Mariposa Lake	JASPER
Meadow Lake	ADAIR
Rathbun Reservoir	APPANOOSE

The following lakes are the additional eighty-eight of the one-hundred and thirty-one identified by the Iowa Department of Natural Resources as Significant Publicly-Owned Lakes.

LAKE NAME	COUNTY
Arrowhead Lake	SAC
Arrowhead Pond	POTTAWATTAMIE
Avenue of the Saints Pond	BREMER
Badger Creek Lake	MADISON
Badger Lake	WEBSTER
Beaver Lake	DALLAS
Beeds Lake	FRANKLIN
Big Spirit Lake	DICKINSON
Bob White Lake	WAYNE
Briggs Woods Lake	HAMILTON
Browns Lake	WOODBURY
Casey Lake (aka Hickory Hills Lake)	TAMA
Center Lake	DICKINSON
Cold Springs Lake	CASS
Coralville Reservoir	JOHNSON
Crawford Creek Impoundment	IDA
Dale Maffitt Reservoir	POLK
DeSoto Bend	HARRISON
Dog Creek (Lake)	OBRIEN
Don Williams Lake	BOONE
East Lake (Osceola)	CLARKE
East Okoboji Lake	DICKINSON
Eldred Sherwood Lake	HANCOCK
Fogle Lake S.W.A.	RINGGOLD
Green Belt Lake	BLACK HAWK
Green Castle Lake	MARSHALL
Greenfield Lake	ADAIR
Hooper Area Pond	WARREN
Indian Lake	VAN BUREN
Ingham Lake	EMMET
Iowa Lake	IOWA
Lacey Keosauqua Park Lake	VAN BUREN

LAKE NAME	COUNTY
Lake Cornelia	WRIGHT
Lake Hendricks	HOWARD
Lake Icaria	ADAMS
Lake Meyer	WINNESHIEK
Lake Miami	MONROE
Lake Pahoja	LYON
Lake Smith	KOSSUTH
Lake Sugema	VAN BUREN
Little Sioux Park Lake	WOODBURY
Little Spirit Lake	DICKINSON
Littlefield Lake	AUDUBON
Lower Pine Lake	HARDIN
Manteno Park Pond	SHELBY
Meyer Lake	BLACK HAWK
Mill Creek (Lake)	OBRIEN
Minnewashta Lake	DICKINSON
Mitchell	BLACK HAWK
Moorhead Park Pond	IDA
Mormon Trail Lake	ADAIR
Nelson Park Lake	CRAWFORD
Nine Eagles Lake	DECATUR
North Twin Lake	CALHOUN
Oldham Lake	MONONA
Orient Lake	ADAIR
Otter Creek Lake	TAMA
Ottumwa Lagoon	WAPELLO
Pierce Creek Pond	PAGE
Poll Miller Park Lake	LEE
Red Rock Reservoir	MARION
Roberts Creek Lake	MARION
Rodgers Park Lake	BENTON
Saylorville Reservoir	POLK
Silver Lake	DICKINSON
Silver Lake	WORTH
Silver Lake	PALO ALTO
Slip Bluff Lake	DECATUR
South Prairie Lake	BLACK HAWK
Spring Lake	GREENE
Springbrook Lake	GUTHRIE
Swan Lake	CARROLL
Thayer Lake	UNION
Three Mile Lake	UNION
Trumbull Lake	CLAY
Tuttle Lake	EMMET
Twelve Mile Creek Lake	UNION
Upper Gar Lake	DICKINSON
Upper Pine Lake	HARDIN
Volga Lake	FAYETTE
West Lake (Osceola)	CLARKE
West Okoboji Lake	DICKINSON
White Oak Conservation Area Lake	MAHASKA
Williamson Pond	LUCAS
Willow Lake	HARRISON
Wilson Park Lake	TAYLOR
Windmill Lake	TAYLOR
Yellow Smoke Park Lake	CRAWFORD

Appendix D. Lake Restoration Prioritization Process and Program

Key Concepts and Facts

- Six of ten Iowans visit lakes each year; they will visit these lakes eight times during the year
- Iowans prefer lakes with better water quality
- Statewide our lakes generate $1.6 billion in annual spending by Iowans
- A lake is a reflection of both watershed and lake management
- Lake restoration starts in the watershed; it relies on strong local involvement and voluntary participation of landowners

Current Prioritization and Program

- Modeled after the Federal Clean Lakes Program established in the 1970s
- DNR provided the 2006 legislature with a priority list of 35 lake candidates
  - Priorities based on a 5-year ISU/DNR assessment of water quality
  - Technical feasibility of restoration
  - Potential economic benefits
  - Use by Iowans, and local interest/involvement
- Projects require a lake and watershed restoration assessment and plan
- Projects require local resources in combination with state and federal funds
- Local groups can petition to have their lake added to the priority list
- Project Status
  - 7 Near completion
  - 26 In progress
  - 6 Planning stage
- DNR provides an annual progress report to the legislature that includes a work plan and budget

Water Quality Goals

Stipulated in 2006 State Legislation (HF2782):

- Delivery of phosphorous and sediment from the watershed will be controlled before lake restoration begins
- Shallow lakes management will be considered among options for restoration
- Water quality targets
  - Clarity. 4 ½ foot secchi disc transparency 50% of the time from April – September
  - Biota. A diverse, balanced, and sustainable aquatic community must be maintained
  - Impairment. Water quality impairments must be eliminated
  - Sustainability. The water quality and public use benefits must be sustained for 50 years

Budget

- 2007 funding $8.6 Million
- 2008 funding $8.6 Million
- 2009 / 2010 funding $12.8 Million
- 2011 $8.6 Million requested

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